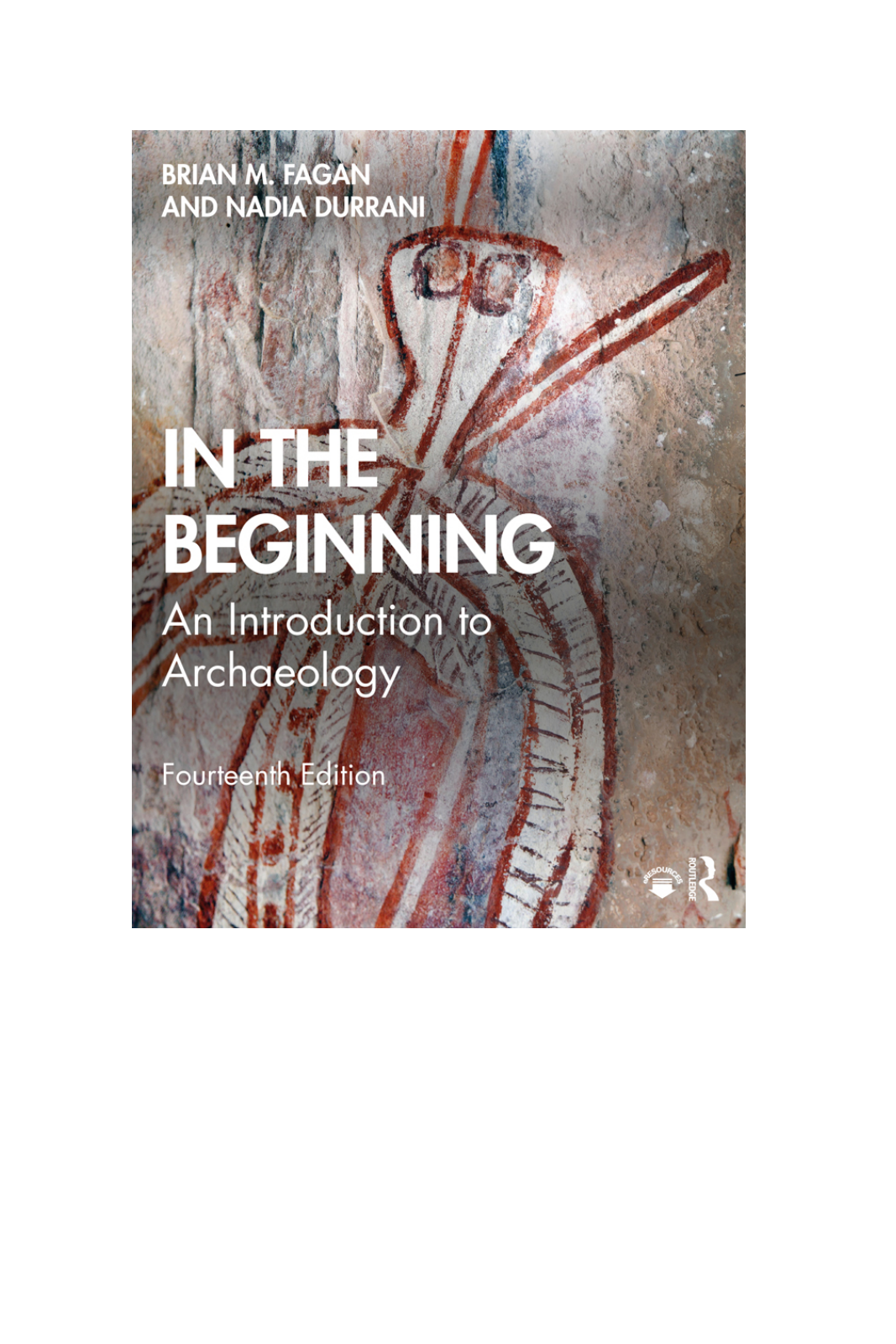


The background of the book cover is a photograph of a rock surface covered in ancient paintings. The most prominent feature is a large, stylized figure drawn with red ochre. The figure has a rounded head with two circular eyes, a long, pointed nose, and a body with vertical lines. The rock surface is textured and shows other faint, less distinct paintings in various colors.

BRIAN M. FAGAN
AND NADIA DURRANI

IN THE BEGINNING

An Introduction to
Archaeology

Fourteenth Edition





In the Beginning

"In the Beginning offers an expansive yet accessible explanation of what archaeologists do. The experience of finding and excavating sites

is revealed, and we learn the strategies and skills archaeologists employ to recover and interpret evidence. The book places archaeological thinking and practices in contemporary social contexts, and provides compelling guidance to readers intrigued by the subject.”

Peter Hiscock, *University of Sydney, Australia*

In the Beginning describes the basic methods and theoretical approaches of archaeology. This is a book about fundamental principles written in a clear, flowing style, with minimal use of technical jargon, which approaches archaeology from a global perspective.

Starting with a broad-based introduction to the field, this book surveys the highlights of archaeology’s colorful history, then covers the basics of preservation, dating the past, and the context of archaeological finds. Descriptions of field surveys, including the latest remote-sensing methods, excavation, and artifact analysis, lead into the study of ancient environments, landscapes and settlement patterns, and the people of the past. Two chapters cover cultural resource management, public archaeology, and the important role of archaeology in contemporary society. There is also a chapter on archaeology as a potential career. *In the Beginning* takes the reader on an evenly balanced journey through today’s archaeology. This well-illustrated account, with its numerous boxes and sidebars, is laced with interesting, and sometimes entertaining, examples of archaeological research from all parts of the world.

This classic textbook of archaeological method and theory has been in print for nearly 50 years and is used in many countries around the world. It is aimed at introductory students in archaeology and anthropology taking survey courses on archaeology, as well as more advanced readers.

Brian M. Fagan is one of the world’s leading writers about archaeology and an internationally recognized authority on world prehistory. He studied archaeology and anthropology at Pembroke College, Cambridge University, and then spent seven years in sub-Saharan Africa. Now a distinguished professor emeritus, from 1967 to 2013 he was a professor of anthropology at the University of California, Santa Barbara. Brian has written seven bestselling textbooks and numerous general books on

archaeology, ancient climate change, and other topics.

Nadia Durrani has contributed to a wide range of archaeological publications and is the former editor of Britain's two bestselling archaeological magazines, *Current Archaeology* and *Current World Archaeology*. Over the years, she has authored and edited countless articles and books, including co-authoring a portfolio of books with Brian. Her background is in Arabian archaeology, and following a degree in archaeology and anthropology from Cambridge University, she took a PhD in southwest Arabian archaeology from University College London. Nadia remains actively involved in Arabian studies and is on the board of the International Association for the Study of Arabia. She is also a founding member of the Great War Archaeology Group and a fellow of the Society of Antiquaries.

Figure 0.1 The Great Wall of China.

Source: Courtesy of National Geographic/Superstock.

In the Beginning

An Introduction to Archaeology

Fourteenth edition

Brian M. Fagan and Nadia Durrani

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Figure 0.2 The Temple of Amun at Luxor, Egypt. View painted by David Roberts (1796–1864).

Source: Courtesy of Art Collection 2/Alamy Stock Photo.

To

Milton Johnson, who believed in this book and started it all those years ago. Thank you!

The whole earth is the sepulcher of famous men; and their story is not graven only on stone over their native earth, but lives far away, without visible symbol, woven into the stuff of other men's lives. For you now it remains to rival what they have done.

—Thucydides, *The Funeral Oration of Pericles*

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Preface

Looming pyramids, mysterious lost civilizations, royal tombs laden with gold: The romance of archaeology never ceases to fascinate and amaze. The stereotype of the archaeologist as adventurer and swashbuckler originated in the nineteenth century, when both archaeologists and the ancient civilizations they uncovered were the stuff of adventure in remote lands. Today, more than 150 years of archaeological investigations have turned archaeology into a meticulous science with roots in both history and a wide variety of scientific disciplines. But the excitement is still there, in the many diverse and highly detailed reconstructions of life in the past that come from scientific inquiry. Archaeologists have reconstructed the lifeways of the earliest humans, documented some of the earliest art in the world, outlined the processes of plant domestication, and even examined the garbage produced in modern urban America. In this book, we describe how archaeologists make and study such finds to illuminate the human past.

New to This Edition

- In response to user requests, [Chapter 3](#) contains more archaeological theory, moved from the back of the book.
- [Chapter 7](#) includes new coverage of the “new radiocarbon revolution” that is yielding remarkably precise dates for important, and long-debated, archaeological problems.
- [Chapters 8](#) and [9](#), which cover archaeological survey and excavation, have been completely revised, with new examples and an important discussion of cutting-edge remote sensing

research at Stonehenge, England. Special attention is paid to LiDAR survey, which promises to revolutionize our understanding of ancient cities and landscapes.

- [Chapters 12 to 17](#) have been updated and include new boxes that cover such diverse topics as a spectacular Moche woman's grave and statistical methods used to study an Anglo-Saxon cemetery. We also cover new research in bioarchaeology that relates to ancient individuals.
- [Chapter 18](#), "Cultural Resource Management (CRM) and Public Archaeology," offers an updated summary of the major issues surrounding these important aspects of archaeology, as well as an important new example from Tucson, Arizona, and London's spectacular Crossrail Project. A stand-alone chapter on these topics has appeared in this book since 1981.
- [Chapter 19](#), "Archaeology and Contemporary Society" covers many issues likely to be of growing importance for archaeologists of future generations.
- [Chapter 20](#), "So You Want to Become an Archaeologist," now includes the results of recent studies on archaeology as a career, while retaining its frank coverage.
- Seven photo essays titled "People of the Past" appear throughout the book, covering such luminaries as pharaoh Rameses II and societies, like the Cro-Magnons of late Ice Age Europe.
- Spectacular discoveries are featured in Discovery boxes, many reflecting an explosion in archaeological discoveries in recent years. These include the earliest irrigation works in the world from Liangzhu, China; the discovery of English King Richard III's burial; and new research at the pharaoh Akhenaten's capital at El-Amarna, Egypt.
- This edition includes an updated illustration program.

This book focuses on the basic principles of our discipline, on the fundamental tenets that are equally important whether one uses a trowel, a laser recording system, or a complicated computer graphics program in pursuit of the past. We use specialized terminology as little as possible and define every new term when it first appears. We hope that you'll pursue the topics that interest you in more advanced and

specialized archaeology courses or in the many excellent books and articles listed in the bibliography at the back of the book.

When I (Brian) started writing the first edition of *In the Beginning*, back in 1968, I had no idea that it would still be in print 40 years later and that I'd one day be revising it for the fourteenth time! *In the Beginning* has become an integral part of my life, and I'm humbled to hear it referred to as a "venerable classic." "Classic" is flattering; perhaps "venerable" reflects advancing years. At any rate, I'm very proud that the book at 45 years and counting has introduced a large number of people to the delights of archaeology over the years. I'm also grateful to the many colleagues who have taken the trouble to make sure I know that they first encountered archaeology through its pages.

This new edition is the second with colleague and co-author Nadia Durrani. She brings aboard a wealth of field experience in Arabia, Britain, and elsewhere, plus extensive writing and editorial experience as the long-term co-author of several of my other textbooks, co-author on a number of my general books, and as the former editor of two leading archaeology magazines.

May you enjoy the world of the past as much as we do! Good luck with your adventures in archaeology—and please be a careful steward of the past for future generations.

This fourteenth edition of *In the Beginning* reflects not only our biases but also the teaching experience of hundreds of instructors over the years whose comments have been invaluable. Almost all of them have urged that we retain the basic format and global coverage of earlier editions. Despite attempts to telescope some chapters into others, the existing organization, honed as it has been over 13 editions, seems to work well for most users. Every archaeological textbook on the market (and there are now many) uses the same general organization, so it obviously works for most people. Two innovations developed some years ago for the tenth edition are retained for this one: the first is an introduction entitled "What Happened When and Where: A Brief Journey Through Ancient Times"—designed to give the beginning reader a brief summary of world prehistory as a reference point for the examples that appear in the main text. The last chapter—"So You Want to Become an Archaeologist?"—gives frank advice about archaeology as a career; it has been very popular with readers and returns here.

Some General Thoughts

We live in ever-changing, uncertain times, in a world where archaeology is changing rapidly. Nevertheless, the basic principles change little over the years—the importance of context, of time and space, of meticulous excavation methods and precise recording, the basics of artifact classification, zooarchaeology, and ethnographic analogy. However, important trends have surfaced in recent years, some a direct result of the dominant role of cultural resource management in today's archaeology. These trends include an increasing emphasis on field survey and high-technology methods for locating, surveying, and mapping sites, also on “nonintrusive archaeology”: nondestructive ways of recording sites and their features.

There's also a realization that there are many ways of thinking about the past, of which the archaeological perspective is one. This has triggered a long, and often passionate, debate not only about the morality of archaeology and the ways in which we practice archaeology in North America but also about the relationships between archaeologists and indigenous peoples. This debate includes the important issue of burials and skeletal material. Many of today's archaeologists are now concerned with new issues of archaeological and cultural tourism, heritage, and conservation.

For all these emerging issues, there is still a need for a sound basic grounding in archaeological methods and theoretical approaches, for courses and texts that introduce a beginning student to the fascination and intricacy of modern-day archaeology. This book is a predominantly academic introduction to archaeology, with a deliberately international flavor. It covers stewardship, archaeological ethics, cultural resource management, and the vanishing archaeological record—all important aspects of archaeology. But the main focus of the book is on the basic intellectual and practical principles that underpin archaeology everywhere, whether a painstaking excavation of an early hominin camp in Africa, a once-thriving Mesopotamian city, a Native American town, or a weeklong contract to investigate an urban lot in the heart of New York City. *In the Beginning* aims at students with no background in archaeology whatsoever and deals with basic principles.

We archaeologists are engaged in intense debates about the future of

the discipline and about its role in the contemporary world, debates stimulated in part by the divisive and fractious times in which we live. What is happening in archaeology has already happened in many other sciences and is still taking hold in much of biology: the development of distinctive and scientific methods and theories that not only enrich our understanding of the past but also add to our understanding of ourselves. Inevitably, these developments have led to ever more intense specialization in ever more high-tech methods and increasingly esoteric research. This high degree of specialized research and the overspecialized archaeologists who accompany it are not necessarily a positive development.

Esteemed colleagues and instructors, please encourage your students to think of archaeology as one enterprise, not as dozens of unrelated activities. Above all, encourage them to look at the broad picture as well as at the local one, for the greatest advances in archaeology, as in other sciences, have come not from slavish specialization but from inspirations born of broad vision. This is why this book unashamedly draws on examples from many parts of the world. It is myopic to teach archaeology from a narrow—say, Australian, British, Chinese, or North American—perspective when our discipline encompasses so much more fascinating research into the brilliant diversity of our forebears.

It would have been easy to make this book a mere catalog of method and theory and to stretch it to 1,000 pages, but as the great archaeologist Sir Mortimer Wheeler said over a half-century ago (1954), “Dry archaeology is the driest dust that blows.” We’ve done everything we can to make this book an interesting read, keeping jargon to a minimum. In the interest of brevity, we’ve had to cover some topics, such as population-carrying capacity and sampling, in almost indecent haste. We’ve also omitted discussion of the more exotic experimental methodologies that now crowd the pages of archaeological literature and more advanced textbooks. Although valuable, many of them are not strictly relevant to the basic goals of archaeology outlined in these pages. We leave it to you to fill in details on topics that you think are inadequately covered here.

We do urge you, however, to give full coverage to the growing crisis of the archaeological record. This subject demands full factual and moral coverage in all introductory courses, where many students arrive

with the notion of finding buried treasure or collecting beautiful artifacts. Every course in archaeology must place responsibility for preserving the past emphatically in public, as well as professional, hands. It is for this reason that this book ends with a stark statement of basic archaeological ethics for everyone.

In the Beginning surveys the broad spectrum of archaeological method and theory. With the very first edition, Brian decided not to espouse any one theory of archaeology and to provide global coverage of archaeology, to give each instructor a basis for amplifying the text with his or her own viewpoint and theoretical persuasion. Many users have endorsed this decision—we see no reason to rethink it. A reviewer said many editions ago: “This is the fun with this book.” Long may it continue to be so!

A Note on Dates

The following conventions are used in this book:

- Dates before 10,000 years ago are expressed in years before present (B.P.). By scientific convention, “present” starts at A.D. 1950.
- Dates after 10,000 years ago are expressed in years before Christ (B.C.) or anno domini (A.D.).
- Another sometimes used convention, B.C.E. or C.E. (Before Common Era or Common Era), is not used in this book.

All radiocarbon dates and potassium-argon dates are statistical estimates and should be understood to have a plus-or-minus factor that is omitted from this book in the interests of brevity. Where possible, radiocarbon dates have been calibrated with tree-ring chronologies to add a substantial element of accuracy (see [Chapter 7](#)). For calibration of radiocarbon dates, see Reimer et al., 2004).

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Thank you one and all.

*Brian Fagan
Nadia Durrani*









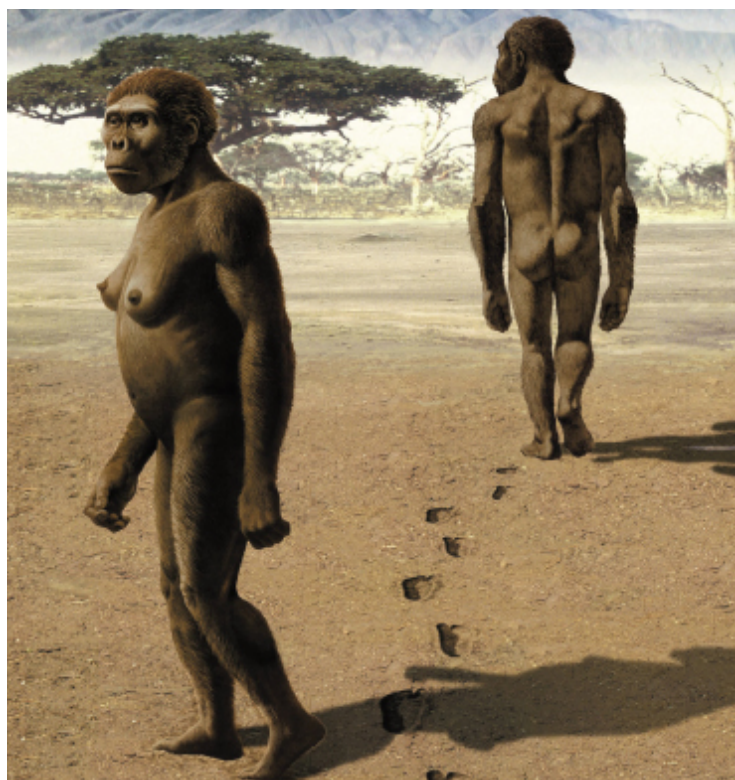
The following are maps showing sites and locations mentioned in the text. For obvious reasons, some locations, mostly minor or obscure locations, or places near major modern cities, are omitted; sometimes, also, when map space is limited. Google Maps will zero in on many such locations.

Map 0.1 Archaeological sites in Africa and Southwest Asia.

Map 0.2 Archaeological sites in Europe.

Map 0.3 Archaeological sites in North and South America.

Map 0.4 Archaeological sites in Asia.



Homo erectus













What Happened When and Where: A Brief Journey Through Ancient Times

In the Beginning describes the basic methods and theoretical approaches of scientific archaeology. In so doing, it uses many examples from the entire 3.3-million-year (or longer) time span of the human cultural past. Although the historical sites described in these pages are probably familiar to most readers, there is value in providing a short summary of the remoter human past as a framework for the chapters that follow. This is, at best, a cursory story.

Human Origins and the Archaic World

In 1871, Charles Darwin, the Victorian biologist who is the father of

modern evolutionary theory, hypothesized that humanity originated in Africa. He based his argument on the great diversity of ape forms south of the Sahara Desert and on the close anatomical relationships between humans and such living primates as the chimpanzee. Darwin was almost certainly correct, and all the data indicate that humanity did indeed evolve in tropical Africa. Staggering advances in multidisciplinary research have changed our perceptions of human origins dramatically since 1959, when Louis and Mary Leakey announced the discovery of a robustly built human at Olduvai Gorge in Tanzania, East Africa. At the time, the entire span of the human past was thought to encompass a mere quarter of a million years. Soon, the hominin-bearing levels at Olduvai were potassium-dated to over 1.75 million years ago (Ma).

We now know that the story of human evolution is far longer and yet more complex. It begins with the separation of the chimpanzee and human lines from a common, as yet unknown ancestor, more than 7 Ma. All the species on this lengthy human lineage are defined as **hominins**. We know of more than 25 hominins based on the current fossil record. However, only some of them are our ancestors, and many became extinct without giving rise to new species. The relationships between these hominins is often complex, but physical anthropologists use various aspects of their fossil remains to put them into different groups, or *genera*, including *Homo* to which our species belongs. Of all the millions of years of human evolution, only one hominin still walks the earth: *Homo sapiens*, the wise person, us.

In this section, we will introduce some of the main actors in the human evolution story. Keep in mind that we are not working with a neat linear ladder of human evolution (as the early researchers imagined) and do not assume that each one creature morphs into the next. There are many gaps on the sprawling family tree that are still to be filled!

First up is *Sahelanthropus tchadensis* from Chad, the earliest known *possible* hominin, who may date to between 7 and 6 Ma. The next key hominin was “Ardi,” *Ardipithecus ramidus*, who appeared in Ethiopia around 4.5–4.3 Ma, and provides us with good insights into early human bipedalism (walking on two feet being a key characteristic of the hominins). It was followed *Australopithecus anamensis*, dated to

4.2–3.9 Ma, the first of the australopithecines (or “Southern Ape-people”), again found in Ethiopia and also Kenya. Thereafter came various other australopithecines, including the relatively well-known *Australopithecus afarensis*, who flourished 3.7–3.0 Ma, in Ethiopia, Kenya, and Tanzania. Sometime during this era, hominins began using crude stone tools, as evidenced by the 3.3 Ma tools recently found in Kenya, potentially the work of the local *A./Kenyanthropus platyops* (which smashes the old assumption that stone tool making was specific to our genera, *Homo*.)

By 2 Ma, the hominin line had radiated into many forms, among them the robust and more gracile australopithecines and the larger-brained *Homo habilis*—the first creature belonging to our genera. *H. habilis* was a forager who also scavenged game meat and perhaps hunted. These hominins lived from roughly 2.4–1.6 Ma and are known from Kenya, Ethiopia, and South Africa. They used a simple yet effective stone technology, the Oldowan (2.6–1.5 Ma), which remained relatively unchanged throughout its use.

Figure 0.1 Hominins walking on soft volcanic ash at Laetoli, Tanzania, circa 3.6 million years ago.

Source: Courtesy of Science Source.

The First “True” Humans

New definitions of our genus, *Homo*, make a major distinction between the more apelike hominins who flourished before 2 Ma and the first of the “true” humans, beginning with the African *Homo erectus*, or “upright man” (sometimes known as *Homo ergaster*, or “the workman”). It evolved after 1.9 Ma, and is known from various sites across the African Rift Valley—Kenya, Tanzania, and Ethiopia—as well as in South Africa. It, or its close relative, then radiated out of Africa into Asia, perhaps by 1.8 Ma. At about the same time, a small number of *H. erectus* (sometimes known as *H. georgicus*) settled in eastern Europe, but seem to have been defeated by harsh climatic conditions. These population movements were part of a general radiation of mammalian species soon afterward. In Asia, *Homo erectus* evolved slowly in Asia, relying both on stone technology and bamboo artifacts

in forested environments, surviving until after 100,000 years ago and possibly as recently as 30,000 years ago.

Meanwhile, we have evidence for *Homo heidelbergensis*, a new human form with a larger brain, who feasibly evolved out of *Homo erectus/ergaster* in tropical Africa. *H. heidelbergensis* may be associated with more sophisticated tool technology known from the distinctive, refined Acheulean hand axes that appear after about 600,000 years ago. This was the time when hominins settled in Europe permanently. *H. heidelbergensis* (c.600,000–200,000 years ago) is believed by many to have been the last common ancestor of the Neanderthals (of Europe, the Near East, and western Eurasia), and of us, the African-origin *H. sapiens*.

Neanderthals (c.350,000–28,000 years ago) were far more developed than any previous hominin: they developed more sophisticated tool-making technology, adapted successfully to the extreme temperatures of the late Ice Age, were far more skilled as hunters and foragers, and were the first humans to bury some of their dead (Figure 0.3). Neanderthals, and indeed the little understood Denisovans, disappear from the fossil record by roughly 30,000 years ago.

The Origins and Spread of Anatomically Modern Humans

So how do we, the *H. sapiens*, fit into all this? As observed earlier, in over 6 million years of hominin evolution, we are the only humans to remain. We are the “wise people,” capable of fluent speech and intelligent reasoning, brilliant innovators with the ability to adapt successfully to every extreme environment on earth.

There used to be two big competing theories to account for our appearance: the “multiregional hypothesis” and the “out-of-Africa” model. The multiregional hypothesis argued that modern humans developed independently in Africa, Europe, and Asia and that the biological diversity of contemporary humankind has very deep roots in prehistory (in other words, modern people developed out of the hominins already living in a given part of the world, so, for example, “modern Asians” developed out of the Asian *H. erectus*, and so on). However, all of the available evidence now supports the “out-of-Africa”

hypothesis, namely that all modern humans evolved in Africa and then spread into other parts of the world.

Figure 0.2 Artist's reconstruction of *Homo erectus* showing the modern-looking limbs and more archaic head.

Source: Courtesy of Universal Images Group North America LLC/Alamy Stock Photo.

Figure 0.3 Model of a Neanderthal male.

Source: Courtesy of Agencja Fotograficzna Caro/Alamy Stock Photo.

Nonetheless, the dating and nature of this spread are controversial. This point is illustrated by the 2017 work on Jebel Irhoud in Morocco, northwest Africa, which has not only pushed back the date of the first known *H. sapiens* to a remarkable 350,000–280,000 years ago (previously the oldest-known evidence was just under 200,000 years old) but has also shown that our cradle was not restricted to East Africa as had previously been assumed.

Incidentally, these very early *H. sapiens* show a mosaic of archaic and modern traits and are not fully anatomically modern humans (AMHs)—indeed, the earliest-known evidence for fully AMHs dates to around 120,000 years ago. In terms of subsequent timings for the AMH movement out of Africa, one school of thought believes there was a single out-movement, perhaps around 83,000 years ago. A competing hypothesis argues for two exits, one before 80,000 years ago, the other one after about 70,000 from Southwest Asia. The issue is unresolved, but it is certain that the diaspora of modern humans was a long, complex process involving small groups of people.

The current evidence suggests we first settled in China and East Asia probably as early as 70,000 years ago. A similar date may be offered for New Guinea and Australia: during much of the last glaciation, New Guinea and Australia formed a single landmass called Sahul, and the data suggest it may have been settled perhaps as early as 50,000–70,000 years ago, probably as a result of deliberate voyaging. However, securely dated sites proliferate in Australia only after 35,000 years ago. Sometime during the late Ice Age, between 50,000 and 40,000, AMHs then spread into Europe and Eurasia from Africa and Southwest Asia

(though there is evidence for an early, temporary occupation of Southwestern Asia by modern humans from Northeast Africa, around 120,000–100,000 years ago).

Figure 0.4 Map showing the spread of modern humans out of tropical Africa.

A permanent presence of AMHs in Europe is associated with the appearance of the Aurignacian culture after about 39,000 years ago. At this point, *Homo neanderthalensis*, the Neanderthals, still roamed their homeland of western Asia and Europe. What happened to the Neanderthals is still a matter of heated debate. Some researchers argue that they were wholly replaced by the African origin *H. sapiens*, others that they wholly interbred. The genetic evidence suggests there was limited interbreeding. But ultimately, the reasons for their demise remain unclear.

And so, by 28,000 years ago—if not earlier (the dates are contentious)—we *H. sapiens* were the only remaining humans on earth. It was thought that *Homo floresiensis*, a diminutive hominin relatively recently discovered from the island of Flores in Indonesia, still existed at 12,000 years ago, but in 2016 its end dates were pushed back to around 50,000 years ago. Perhaps our evolutionary winning card was that we responded to the sheer diversity of world's environment with great flexibility. We developed complex societies and elaborate bone and antler technology, as well as a complex symbolic life reflected in intricate artistic traditions (Figure 0.5). Before long, we had moved into almost every corner of the world.

The First Settlement of the Americas

By 25,000 years ago, human beings had penetrated far into northern latitudes, onto the frigid steppe-tundra of central Asia, to Siberia's Lake Baikal, and into extreme northeastern Siberia. But the Americas were still virgin continents, joined to Siberia by a low-lying land bridge during the late Ice Age, when sea levels were about 300 feet (91 m) lower than today. The first settlement of the Americas remains one of the great mysteries of archaeology. Everyone agrees that the ultimate ancestry of the Native Americans lies in northeast Asia and perhaps China, but there is little agreement on when or how the first settlers

arrived in the New World. There are a few unsubstantiated claims for settlement before 20,000 years ago, perhaps even as early as 40,000 years before the present. (A recent 100,000-year or more discovery of a mammoth and allegedly humanly manufactured stone tools from near San Diego, California, is of natural origin.) Unfortunately, none of the sites purported to document such early settlement stands up to close scientific scrutiny. Most archaeologists believe that the first settlers arrived either by crossing the land bridge or perhaps in skin boats along the frigid coastline during the very late Ice Age or immediately thereafter, perhaps as early as 15,000 years ago.

Figure 0.5 A wild ox, *Bos primigenius*, otherwise known as the aurochs, painted by a late Ice Age artist at Lascaux Cave, southwestern France, circa 18,000 years ago.

Source: Courtesy of Hemis/Alamy Stock Photo.

No one knows how the first human settlers moved from Alaska into the heart of the Americas. Perhaps they traveled southward along the coastline along now-submerged shores, or overland, as the great ice sheets that once mantled northern North America retreated at the end of the Ice Age after 15,000 years ago. We do know, however, that hunter-gatherer populations were scattered throughout the Americas by 10,500 B.C., well adapted to every kind of environment from open plains to tropical rain forest. From these early populations developed the great diversity of later Native American societies that were the direct ancestors of the much more elaborate indigenous societies of later times.

The Origins of Food Production

Since 15,000 years ago, the endless cycle of global climate change has moved into another warming mode. The great ice sheets that had covered northern Europe and North America receded rapidly. World sea levels rose closer to modern levels. Global warming brought major shifts in rainfall patterns and vegetation. Birch and oak forests replaced open plains in Europe. The Sahara again supported dry grassland. Birch forests populated much of Canada. Hundreds of animal species, large

and small, became extinct in the face of global warming, among them the long-haired Arctic elephant (the mammoth) and the mastodon. Human societies everywhere adapted to radically different environments, many of them turning to intensive exploitation of small game, fish and sea mammals, and plant foods of every kind.

Many groups settled at the boundaries of several ecological zones or by estuaries, lakes, or seacoasts, where they could exploit diverse food resources and stay in one place for much of the year. In these resource-rich areas, local populations rose considerably and the landscape filled up, to the point at which each group had its own territory and there was sometimes competition for valuable food supplies. By about 10,000 years ago, demographers believe, the Old World was close to the limits of its ability to support growing human forager populations, even in favorable environments.

Post-Ice Age global warming did not proceed steadily but in stops and starts. The mechanisms that drive long- or short-term climatic change are still a mystery, but they are closely connected to changes in the complex interactions between the atmosphere and the ocean, including the circulation of warm water from the tropics to northern latitudes and the downwelling of salt to the ocean floor in the North Atlantic.

Whatever the causes of the change, the past 15,000 years have been marked by dramatic millennia- and centuries-long climatic shifts, among them the famous “Little Ice Age” that caused famines in Europe between A.D. 1400 and 1850. But the most dramatic of these shifts occurred between 11000 and 10000 B.C. when the world suddenly returned to near-glacial conditions during the so-called Younger Dryas event (named after a polar shrub).

Early Food Production in the Old World

The Younger Dryas saw advancing glaciers in northern Europe and North America, while bringing severe drought to southwestern Asia. This drought had catastrophic effects on the sedentary forager populations clustered in favorable environments, such as the Euphrates and Jordan river valleys and elsewhere between Turkey and southern Iraq. Within a few generations, many of these societies turned to the

cultivation of wild cereal grasses as a way of supplementing their other plant foods. Only a few generations passed before wild wheat and barley became domesticated crops and agriculture replaced plant foraging as a staple of human existence. At about the same time, some groups also domesticated wild goats and sheep, pigs, and later, cattle. By 8000 B.C. farming societies were widespread throughout southwestern Asia. Agriculture also began in Egypt's Nile Valley at about the same time, but the exact date remains unknown.

The new economies were brilliantly successful and spread rapidly through the eastern Mediterranean world and around the shores of the Euxine Lake (now the Black Sea), which was then a freshwater lake separated from the Mediterranean Sea by a huge natural earthen bank that crossed what is now the Bosphorus between Turkey and Bulgaria. Farmers lived in Greece and southeastern Europe by 6000 B.C. Some five centuries later, the rising Mediterranean burst through the Bosphorus and flooded the Euxine Lake in a natural disaster that caused the new Black Sea to become brackish and rise hundreds of feet, while displacing the many agricultural societies on its shores. The flooding of the Black Sea may have accelerated the spread of farming peoples northwestward into temperate Europe, where agriculture was well established by 5000–4500 B.C.

Food production did not develop in one region alone. Rice cultivation had developed in southern China along the Yangtze River by at least 6500 B.C. and probably earlier, and cereal agriculture in the north by 6000 B.C. As in southwestern Asia, the new economies were a logical response to growing population densities and unpredictable climatic shifts. In southwestern Asia, southern Asia, and China, food production provided the economic foundation for the world's earliest preindustrial civilizations.

Early Farmers in the Americas

When Europeans arrived in the Americas in the fifteenth century A.D. they marveled at the expertise of native populations with cereal and root crops. The native Andeans domesticated hundreds of potato forms, while maize (corn) was the staff of life for millions of farmers between tropical South America and Canada's Saint Lawrence Valley in

northeastern North America.

Despite intensive research, we still know little of the origins of food production in the Americas. Thanks to accelerator mass spectrometry (AMS) radiocarbon dating and generations of botanical research, we know that maize was domesticated from a wild grass named teosinte somewhere in southcentral Mexico, at least as early as 5000 B.C. , and perhaps earlier. Maize, as well as other crops such as beans, spread rapidly in various strains—into lowland and highland South America by at least 2500 B.C. , and into the southwestern United States by 3250 B.C. The first domestication of the potato took place in the highland Andes at least as early as 2500 B.C. , along with other staples, such as quinoa. There may have been some cultivation in the Andes as early as 8000 B.C.

Maize agriculture spread widely among North American forager societies that had been pre-adapted to food production by millennia of intensive hunting and gathering, often in densely populated environments such as the river valleys and lakes of the midwestern and southeastern areas. Some of these people were already cultivating native plants, such as goosefoot and squashes, many centuries before maize and bean agriculture became established among them.

As in the Old World, the new economies spread rapidly from their points of origin. By the time Europeans arrived, in the fifteenth century A.D. , Native Americans were exploiting hundreds of domesticated plants in every environment where agriculture was feasible. In many areas, such as the highland Andes, growing populations tested the limits of maize and other crops by planting them at ever-higher altitudes and by breeding cold- and drought-resistant strains. It is no coincidence that many Native American crops are now staples of the modern global economy. At the same time, Native Americans domesticated few animals other than the alpaca, dog, llama, and turkey, for they lacked the potentially domesticable animals that abounded in the Old World.

Figure 0.6 Monk's Mound, Cahokia, Illinois, the major temple mound at this important ceremonial center of the Mississippian culture, circa A.D. 1200.

Source: Courtesy of Hemis/Alamy Stock Photo.

Only 2,000 years or so after the domestication of plants, Native American societies in Mesoamerica and the Andean region developed much more complex societies, and soon thereafter, the first indigenous New World civilizations ([Figure 0.6](#)).

The First Civilizations

Five thousand years after farming began in southwestern Asia, the first literate, urban civilizations developed almost simultaneously in southern Mesopotamia and along the Nile River. Their roots lay among increasingly complex farming societies that had become interdependent and centralized. Numerous innovations accompanied the emergence of the first civilizations—intensified agriculture, often relying on irrigation, metallurgy, the sailing ship, and writing among them (see Discovery box).

The origin of state-organized societies is one of the most hotly debated issues in archaeology, for we still lack a definitive explanation of how civilization began. The most plausible scenario combines fast-rising population densities and increased competition for economic and political power with environmental changes that included a stabilization of global sea levels at modern levels. The complex economic, political, and social changes to civilization have been likened to a game of ancient Monopoly that pitted chief against chief in fast-moving diplomatic and economic games where the strongest and most decisive leaders survived.

You can see the process along the Nile River, where increasingly large and more powerful riverside states competed over many centuries. Eventually, powerful rulers in Upper (southern) Egypt conquered the states of the fertile delta region in the north and created a unified kingdom in about 3100 B.C. under a pharaoh (king) named Horus Aha. Over the next few centuries, his successors created a powerful religious ideology and royal culture that turned the pharaoh into a divine ruler with supreme powers on the earth. Egypt's conservative, yet surprisingly flexible, civilization endured for nearly 3,000 years as a preindustrial society that created the pyramids and nurtured some of the greatest rulers in history.

The pathway to civilization in Mesopotamia involved similar

complex processes of environmental, political, and social change in a lowland environment where powerful cities became a patchwork of small city-states that competed over water rights, trade routes, and land. The Sumerian civilization, made up of competing city-states such as Eridu, Ur (see [Figure 0.8](#)), and Uruk, was rarely unified into a large entity until the third millennium B.C. , when the rulers of Ur patched together a civilization that unified, at least nominally, a mosaic of smaller states from the Mediterranean coast to the Persian Gulf. Successive civilizations rose from the disintegration of Sumerian society after 2500 B.C. , when Akkadians based in Babylon to the north created a new empire in southern Mesopotamia, followed in turn by the Assyrians of the first millennium B.C.

DISCOVERY TUTANKHAMUN’S TOMB, EGYPT, 1922

The small party of archaeologists and onlookers stood in front of the doorway that bore the seals of the long-dead pharaoh. They had waited six long years, from 1917 to 1922, for this moment. Silently, Howard Carter pried a hole through the ancient plaster. Hot air rushed out of the small cavity and massaged his face. Carter shone a flashlight through the hole and peered into the sepulcher. Gold objects swam in front of his eyes, and he was struck dumb with amazement.

Lord Carnarvon fidgeted impatiently behind him, as Carter remained silent.

“What do you see?” he asked, hoarse with excitement.

“Wonderful things,” whispered Carter as he stepped back from the doorway (Carter et al., 1923–1933: 63).

They soon broke down the door. In a daze of amazement, Carter and Carnarvon wandered through the antechamber of the pharaoh Tutankhamun’s tomb. They fingered golden funerary beads, admired beautifully inlaid wooden chests, and examined the pharaoh’s chariots stacked against the wall. Gold was everywhere—on wooden statues, inlaid on thrones and boxes, in jewelry, even on children’s stools (Reeves, 2007). Soon Tutankhamun was known as the golden pharaoh, and archaeology as the domain of buried treasure and royal sepulchers (see [Figure 0.7](#)).

As for Carter and Carnarvon, they immediately installed an iron door to the tomb and placed a 24-hour guard at the entrance while they

planned the clearance of the sepulcher. But late that night they returned on their own, chiseled a small hole in the sealed burial chamber, and slipped through to check that the pharaoh lay undisturbed in his sarcophagus.

It took Howard Carter eight years to clear Tutankhamun's tomb, which was one of the greatest archaeological discoveries ever made. Unfortunately, Lord Carnarvon died of an infected mosquito bite shortly after the discovery of the sepulcher. Inevitably, there was journalistic talk of a "curse of the pharaohs" imposed by Ancient Egyptian priests on those who violated the tomb. This is complete hogwash. The fact that most people who worked on Tutankhamun's tomb lived into their eighties is conveniently forgotten!

Figure 0.7 The golden sarcophagus and mask of the Egyptian king Tutankhamun, who died in 1323 B.C.

Source: Courtesy of robertharding/Alamy Stock Photo.

By this time, the civilizations of the eastern Mediterranean world were linked by increasingly close economic ties, to the point that some scholars have written of this as the first "world economic system," perhaps a somewhat grandiose term for a vast region between India and mainland Greece linked by land and ocean trade routes that handled goods and commodities of every kind. By 2600 B.C., Sumerian monarchs in Mesopotamia boasted of ships from distant Meluhha that docked at their ports. Meluhha was probably the Indus Valley in what is now northwestern Pakistan, where an indigenous civilization developed before 2000 B.C. This was a loosely connected riverine civilization with numerous large towns and several large cities, among them Harappa and Mohenjodaro. People of the Indus Valley civilization traded regularly with Mesopotamia on such a scale that it had its own script and systems of weights and measures. The Indus Valley civilization declined about 1700 B.C. A few centuries later, the center of gravity of early Indian civilization moved eastward into the Ganges River valley, where the great Mauryan civilization flourished in the first millennium B.C.

The Greek mainland and Aegean islands nurtured their own distinctive civilizations, which developed from many centuries of long-

distance trade in olive oil, wine, timber, and other commodities. Crete's Minoan civilization prospered from far-flung trade routes that linked the Aegean with the eastern Mediterranean and the Nile Valley. Egyptian inscriptions and paintings show Minoan traders at the pharaoh's court as early as 1600 B.C. and the famous Uluburun shipwreck off the southern Turkish coast in 1310 B.C. chronicles the astounding wealth of foreign trade at the time (see [Figure 1.7](#)). After 1450 B.C. the Mycenaeans ruled both the Greek mainland and Crete, strengthening their ties with the powerful Hittite civilization in what is now Turkey, the Assyrians in Mesopotamia, and the Egyptians. This prosperous, highly competitive world collapsed in political turmoil about 1200 B.C. for reasons that are still little understood. The first millennium B.C. saw the rise and fall of the Persian empire and of Alexander the Great's vast domains, the glories of classical Greece, and then finally, the rise of the Roman Empire, which dominated the western world from before the time of Christ until the Dark Ages.

Figure 0.8 The reconstructed Sumerian ziggurat (temple pyramid) at Ur, Iraq. It was a shrine of the Moon God Nanna, patron deity of Ur.

Source: Courtesy of Fotolia.

As Egyptian and Mesopotamian civilizations appeared in the west, more complex societies developed along the lower and middle reaches of the Yellow River of China. The latter were part of the so-called Longshan culture, sometimes also known as the Black Pottery Culture. By 2500 B.C., the Longshan culture had become highly centralized, with elaborate social organization, and was developing into highly competitive and much larger political units. By about 2000 B.C., Chinese history enters an era of legend with a basis in fact, with the competing Xia, Shang, and Zhou dynasties of the Huang He (Yellow) River. Between 1766 and 1100 the Shang civilization dominated the north, to be succeeded by the Zhou dynasty, which in turn gave way to a historical jigsaw puzzle of warring states that were finally unified by the ruthless and despotic Emperor Shihuangdi in 221 B.C. The emperor is famous for his lavish and still unexcavated royal tomb, guarded by a regiment of spectacular terracotta soldiers.

By the time of Christ, Greek sea captains had discovered the secrets

of the monsoon winds of the Indian Ocean, which allowed a sailing vessel to sail to India and back with favorable winds. Within a few centuries, the Roman world was linked to India and, indirectly, to the Han empire in distant China. The Mediterranean and Asian worlds became interconnected with economic and diplomatic ties that endured until Portuguese explorer Vasco da Gama sailed around Africa's Cape of Good Hope and directly to India along the monsoon route in A.D. 1497. His voyage took place as the European Age of Discovery brought Columbus to the Indies and other explorers to the Pacific and southeastern Asia.

Early American Civilizations

The indigenous civilizations of the Americas developed a brilliant complexity, with many resemblances in general characteristics and organization to preindustrial states in the Old World.

Mesoamerican Civilization

When Spanish conquistador Hernán Cortés and his motley band of followers gazed down on the glittering Aztec capital, Tenochtitlán, in the heart of the Valley of Mexico in 1519, they were astounded by the gleaming temples and palaces that could be seen from miles away. They marveled at the vast market, larger than that in Constantinople, attended by as many as 20,000 people a day. More than 250,000 Aztecs lived in or around Tenochtitlán, which was, at the time, one of the largest cities in the world. Within two years, the Aztec capital was a pile of smoking ruins after months of bitter fighting. Soon, the dazzling Aztec civilization was just a memory.

The Aztec empire developed out of more than 2,500 years of Mesoamerican civilization. The architecture of the Aztec capital, cosmology, religious beliefs, and their institutions of kingship had deep roots in earlier, much-revered, civilizations.

Mesoamerican civilization developed from diverse, ancient village roots, but the religious beliefs and institutions of the Olmec people of the Veracruz lowlands were of paramount importance after 1500 B.C. The Olmec developed their religious ideology and distinctive art style

from farmers' beliefs, which involved both shamanism and a profound belief in the power of the fierce jaguar. By 1200 B.C. , their religious beliefs and the art style that accompanied them were widespread throughout lowland and highland Mesoamerica. Massive, brooding figures of Olmec rulers (see [Figure 17.6](#) on page 350) give an impression of immense shamanistic power, of individuals who traveled freely between the material and spiritual worlds; travel between those two realms is always a feature of Mesoamerican civilization. The Olmec had still little-known equivalents in other parts of the lowlands and highlands, but their influence on later Mesoamerican civilizations was enormous.

As the Olmec flourished, Maya civilization developed out of village cultures in the Yucatán lowlands. Some small ceremonial centers were flourishing by 1500 B.C. A thousand years later, the first large Preclassic Maya cities rose in the southern Yucatán, among them Nakbé and El Mirador, places where kingship became a formal institution and Maya lords became powerful rulers who presided over ever-changing city-states. By A.D. 100, Classic Maya civilization was well under way, as a jigsaw puzzle of city-states large and small competed ferociously for political power, trade monopolies, and prestige. The Maya developed their own indigenous script, whose decipherment was one of the great scientific triumphs of the twentieth century. This decipherment has allowed us to reconstruct not only the complex Maya calendar but also many details of their political history and cosmology. Classic Maya civilization flourished in the southern lowlands until the ninth century. The four largest city-states—Calakmul, Copán, Palenque, and Tikal—were all ruled by long-lived dynasties of authoritative lords ([Figure 0.9](#)).

[Figure 0.9](#) The Maya city at Palenque, Mexico. The Temple of the Inscriptions at left, the palace with its tower at right.

Source: Courtesy of Chico Sanchez/Alamy Stock Photo.

Meanwhile, the great city of Teotihuacán rose to prominence in the highlands. This was a city of more than 120,000 people and a trading and religious center of enormous power ([Figure 0.10](#)). From 200 B.C. to A.D. 600, Teotihuacán was the dominant presence on the highlands, ruled by increasingly militaristic rulers who traded with the city of

Monte Albán in the Valley of Oaxaca and with the Maya, who were strongly influenced by the city's militaristic beliefs. In about A.D. 600, Teotihuacán abruptly collapsed, leaving a political vacuum in the highlands. In the eighth century, Maya civilization collapsed in the southern highlands, probably as a result of stress brought about by drought, environmental degradation, and internal social disorder. The dense urban populations scattered, but Maya civilization endured and flourished in the northern Yucatán until the arrival of the Spanish in 1517.

Figure 0.10 Teotihuacán, looking down the central Street of the Dead. The great Pyramid of the Sun is at the left.

Source: Courtesy of Zoonar GmbH/Alamy Stock Photo.

In the highlands, several centuries passed before the Toltec civilization emerged as a new, dominant force in the Valley of Mexico, only to implode in A.D. 1200, probably as a result of fierce external and internal rivalries. The Aztecs arrived in the valley soon afterward as obscure nomads entering a political environment of vicious competition between well-established city-states. With brilliant diplomatic and military skill, the Aztecs became mercenaries, then conquerors. By 1425, they were masters of the Valley of Mexico and were in the midst of expanding their empire, which extended from the Gulf of Mexico to the Pacific Ocean and from Guatemala to northern Mexico, when the Spaniards gazed on Tenochtitlán in 1519. The Aztecs held their domains together by force and harsh tribute assessments. Inevitably, many vassal cities joined the newcomers as a way of overthrowing the hated Aztec masters, only to suffer a different form of bondage after the Spanish conquest.

Andean Civilization

Andean civilization also developed from ancient village roots. It was to encompass the vast Inca empire, overthrown by Spaniard Francisco Pizarro in the early 1530s. At the time, as many as 6 million people lived under Inca rule, part of Tawantinsuyu, “the Land of the Four Quarters,” which extended from Chile and Bolivia in the south to Ecuador in the north and encompassed the Andes highlands, some

Amazonian rain forest, and the arid Pacific coast.

The origins of Andean civilization may be associated with the intensive exploitation of anchovies and other coastal fish that flourished in the cold Humboldt Current, which flows close to the arid Pacific shoreline. This bounty, when combined with intensive agriculture in irrigated coastal river valleys, provided ample food surpluses for complex societies centered on increasingly elaborate ceremonial centers. By 900 B.C. , a distinctive Andean religious ideology had appeared at Chavín de Huantar in the foothills and spread widely through the entire region along trade routes that linked highlands and lowlands.

The first millennium A.D. saw the development of two poles of Andean civilization. The first, centered on Peru's north coast, consisted of river valley societies that traded cotton, textiles, and marine products such as fishmeal with the highlands. The Moche state, which flourished for much of the early and mid-first millennium A.D. , enjoyed great wealth, as its leaders organized elaborate intervalley canals and irrigation systems. North-coast civilization was volatile and vulnerable to drought and catastrophic El Niño floods. By A.D. 1100, the Chimú state dominated the region, only to be overthrown by Inca conquerors in the fourteenth century.

Figure 0.11 The Inca center at Machu Picchu high in the Andes, Peru.

Source: Courtesy of [naglelestock.com/Alamy](https://www.naglelestock.com/Alamy) Stock Photo.

The southern pole of Andean civilization was centered around the shores of Lake Titicaca and was dominated by a ceremonial site at Pukara, and especially the city of Tiwanaku, which reached the height of its powers in the first millennium A.D. before collapsing in the face of intense drought at about A.D. 1000. The highland plains around Lake Titicaca were conquered early by the Inca, who began aggressive campaigns of conquest to expand their domains after 1438. The Inca empire was at its maximum extent when Spanish conquistadors brought smallpox and destruction to the Andean world in the 1530s (Figure 0.11).

The conquest of the Aztec and Inca empires was part of the final chapter of prehistory, which saw Western civilization expand to every

corner of the world and the creation of the first truly global economy. But the great diversity of humankind in the modern world serves to remind us of our common roots in the remote past, a past reconstructed in large part by archaeology, the only scientific discipline that studies and explains human cultural evolution over long periods of time.



PART I

BACKGROUND TO ARCHAEOLOGY

*My name is Ozymandias, king of kings: Look on my works, ye Mighty,
and despair! Nothing beside remains. Round the decay Of that colossal
wreck, boundless and bare The lone and level sands stretch far away.*

—Percy Bysshe Shelley, *Ozymandias*, 1818

Why study archaeology? What is the importance of this popular and apparently romantic subject? We will begin by looking at the place of archaeology in the twenty-first-century world. We will explain the subject's roots, who we are, and what we do. Unfortunately, the discipline faces a crisis brought about by rapid destruction of important

sites by industrial development and treasure hunting. Furthermore, all kinds of pseudoarchaeologies purporting to tell the truth about lost worlds, ancient astronauts, and sunken continents undermine archaeology's credibility with a wider audience. As this chapter reveals, the reality of archaeology is one of rigor and professionalism, but can be more engaging than any invented Indiana Jones drama.

No one can fully understand archaeology without having some notion of its roots. The first archaeologists were little more than collectors and **antiquarians** who were searching for curiosities, buried treasure, and intellectual enlightenment. These treasure hunters were the predecessors of the early professionals, scholars who concentrated on site description and believed that human society evolved through simple stages, the final stage being modern civilization. Since World War II, archaeology has undergone a major transformation from a basically descriptive discipline into a many-sided activity that tries to understand how human cultures changed and evolved in the past. If there is one major lesson to be learned from the history of archaeology, it is that no development in the field took place in isolation. Innovations in many other disciplines, including geology, cultural anthropology, and computer science, resulted in changes in the way archaeology was carried out in the field and, more importantly, how researchers thought about the past.

Egyptian Queen Nefertari, first Great Royal Wife of pharaoh Rameses II, died 1255 B.C.





(a)



(b)

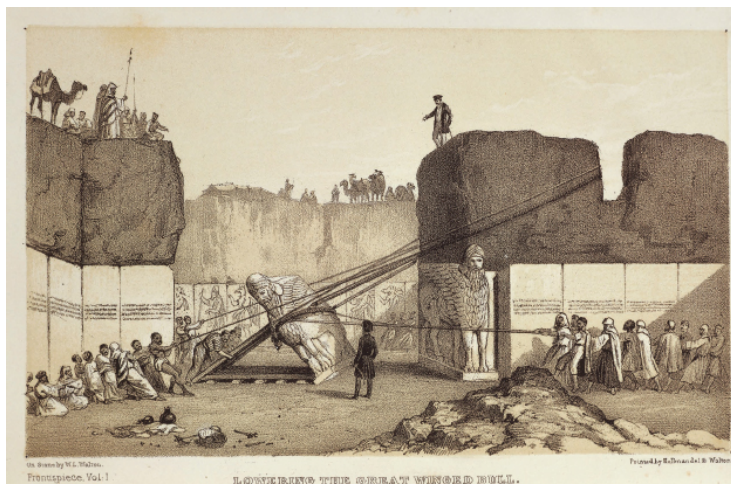
















1

Introducing Archaeology

CHAPTER OUTLINE

The First Archaeologists
What Is Archaeology Today?
Who Are the Archaeologists?
Why Study Archaeology

Who Owns the Past?

Is Archaeology in Crisis?

What Are the Goals of Archaeology?

The Pyramids of Giza and the Sphinx.

Source: Watercolor of the Pyramids of Giza, Egypt, by David Roberts, 1838.

All was mystery, dark, impenetrable mystery, and every circumstance increased it. In Egypt, the colossal skeletons of gigantic temples stand in unwatered sands in all the nakedness of desolation; but here an immense forest shrouds the ruins ... giving an intensity and almost wildness to the interest.

—John Lloyd Stephens, 1841

American traveler John Lloyd Stephens wrote these words as he explored the overgrown ruins of the great Maya city at Copán in Honduras in the mid-nineteenth century. He called Copán the “Mecca or Jerusalem of an unknown people” and made the exploration of the past high drama. It is still a fascinating adventure. Archaeology is the stuff dreams are made of—buried treasure, gold-laden pharaohs, the romance of long-lost civilizations. Many people believe that archaeologists are romantic heroes, like the film world’s Indiana Jones. Cartoonists depict them as elderly, eccentric scholars in sun helmets digging up inscribed tablets in the shadow of Egyptian temples. They are thought to be typical absentminded professors, so deeply absorbed in the details of ancient life that they care little for the pressures and frustrations of modern life. Archaeology is believed to open doors to a world of adventure and excitement, to discoveries, such as the spectacular tomb of the Egyptian pharaoh Tutankhamun, opened by English archaeologists Howard Carter and Lord Carnarvon in 1922. But where does this romantic image come from? For answers, we need only to look to the first archaeologists.

The First Archaeologists

The first archaeologists were indeed adventurers. The Maya civilization of Mexico and Guatemala was first described by American travel writer

John Lloyd Stephens, who traveled in the forests of the Yucatán with artist Frederick Catherwood in 1839. Stephens was already a gifted travel writer, Catherwood an artist with a reputation for spectacular public exhibitions, when they traveled to Central America.

Some early archaeologists dug for profit, others out of intellectual curiosity. None was more single-minded than Heinrich Schliemann, a German businessman (Traill, 1995). In his early forties he gave up business, married a young Greek woman, and set out to find Homer's legendary city of Troy in 1871. His hectic search ended at the mound of Hissarlik in northwestern Turkey, already identified as Troy by the local American consul, Frank Calvert. Schliemann recruited 150 men and moved 325,000 cubic yards of soil in his early seasons (Figure 1.1). He proved the Homeric legends had some basis in reality, but his archaeological methods were brutal; he destroyed almost as much as he discovered.

Archaeology has come a long way since the days when one could find a lost civilization in a month. In this chapter, we define archaeology and explore its role in the modern world. We also discuss archaeology's relationship to other academic disciplines, its goals, and the ethics of studying the past.

What Is Archaeology Today?

Many people still associate archaeology with all the adventure and glamour of the early archaeologists, as mythologized in the Indiana Jones movies—swashbuckling deeds of daring-do, sinister villains, and mythic treasure. And, of course, Harrison Ford and the good people win in the end. Great, crackling Hollywood stuff, which bears absolutely no resemblance to what modern archaeologists really do. There's another popular misconception, too, that has archaeologists unearthing spectacular dinosaur fossils and all kinds of vicious creatures that flourished on earth long ago. Archaeologists study people; paleontologists research dinosaurs and other long-vanished animals. People never lived alongside dinosaurs, which became extinct about 66 million years ago. The earliest hominins appeared perhaps 6 or 7 million years before the present.

As witnessed earlier, a century ago, much of archaeology was a

scramble for artifacts, spectacular and unspectacular, wrested from ancient cities and tombs. The old stereotype of a pith-helmeted professor digging in the shadow of a mighty pyramid had an element of truth in it. However, long gone are the days when an archaeologist would discover three royal palaces along the Tigris River in a week (this actually happened). Today, archaeology is a highly sophisticated, multidisciplinary science, which draws on a broad array of scientific methods. We used to be thought of as excavators in remote lands. Many archaeologists (including both authors of this book) do still work far from the beaten track, but some of today's most spectacular discoveries come from air-conditioned laboratories. This, for example, is how we know that the Ancestral Pueblo people of Chaco Canyon, New Mexico, imported cacao from Mexico to make chocolate drinks. Microscopic residues on pot fragments revealed the exotic import (Washburn et al., 2011).

Figure 1.1 Nineteenth-century excavation on a near-industrial scale. Heinrich Schliemann's excavations at Hissarlik (Troy) in northwest Turkey.

Source: Courtesy of Interfoto/Alamy.

Discovery Catherwood And Stephens At Copán, Honduras, 1839

Scottish-born artist Frederick Catherwood (1799–1854) and New York adventurer and lawyer John Lloyd Stephens (1805–1852) formed a remarkable archaeological team. Hearing persistent rumors of great cities in the rainforests of the Yucatán, they sailed for Belize and Guatemala in October 1839 in search of lost civilizations. They set off inland with a small party and five mules. After a difficult journey through rough country, they arrived at the remote village of Copán, where they saw well-preserved stone walls across the river. Crossing the stream, they climbed a set of steps to a terrace completely mantled in vegetation. They stumbled across the terrace to the foot of a pyramid and came on a square stone column elaborately sculpted in bold relief. “On the front side was carved the figure of a man (evidently a portrait) curiously and richly dressed, whose face was solemn, stern, and well fitted to excite terror.” Fascinated, they followed their guide as he cut

his way through the undergrowth. Catherwood paused to note and sketch fine sculptures. The brooding trees and clinging brush seemed to preserve profound stillness over the ruins. Stephens wrote: "The only sounds that disturbed the quiet of this buried city were the noises of monkeys moving along the tops of the trees and the crackling of dead branches broken by their weight." Processions of 40 or 50 of them moved overhead, "like wandering spirits of the departed race guarding the ruins of their former habitations." Copán was a kaleidoscope of sculptures, steps, and dense vegetation that powerfully affected the explorers. Few ancient cities have ever been described so eloquently. Stephens wrote: "The city was desolate. No remnant of this race hangs round the ruins... . It lay before us like a shattered bark in the midst of the ocean." Meanwhile, Catherwood stood ankle-deep in mud trying to copy the intricate carvings on the weathered stelae (columns) set in Copán's great plaza.

Everything was a mystery; they never knew what they would find next. "I leaned over with breathless anxiety while the Indians worked, and an eye, an ear, a foot, or a hand was disentombed ... when the machete rang against the chiseled stone, I pushed the Indian away and cleared out the loose soil with my hands" (quotes from Stephens, 1841: 271–273).

Stephens wanted to buy Copán and ship it back to New York piece by piece. However, the river was unsuitable for rafts, so he contented himself with buying the site for 50 dollars. The landowner thought he was an idiot; Stephens thought that he had the bargain of the century. Using a compass and a well-used tape that Catherwood had used in Egypt, the two men completed a rough survey of the core of the ruins over three days. As the artist sketched, Stephens wandered through courts and temples that extended over 2 miles (3.21 km) and pondered the mystery of the builders (Figure 1.2). Subsequently, artist and adventurer visited another Maya site at Palenque, then returned to New York where Catherwood's paintings caused a sensation. Stephens wrote a classic account of their adventures, *Incidents of Travel in Central America, Chiapas, and Yucatan*, which became a best seller when it appeared in 1841.

Today, Copán is a major tourist destination and one of the most thoroughly studied Maya cities. The forest is gone, so it is hard to recall

what the site must have been like when Catherwood and Stephens cut their way through it. You have to visit more remote, little-explored cities, such as the major center at Naranjo near perhaps the greatest Maya city of all, Tikal in Guatemala, to experience the modern equivalent. A dense tree canopy mantles the plazas; dense undergrowth covers the pyramids. When you clamber to the summit, you suddenly emerge from the trees and look across the forest. As you wander through this large, deserted city, you feel some of the emotions felt by Catherwood and Stephens when confronted by a totally unfamiliar civilization—exotic, flamboyant, and quite unlike those of Egypt and the Mediterranean world. And we're lucky that the brilliant artistic and literary gifts of these two explorers rank among the immortal descriptions of ancient cities.

Figure 1.2 Copán, Honduras. (a) Stela F, A.D. 721, which Frederick Catherwood sketched during his time at the site. (b) The cleared ruins today.

Source: Courtesy of Fabienne Fosse/Alamy Stock Photo and Jordi Camí/Alamy Stock Photo.

Archaeology is the study of all aspects of past human experience primarily using the material (physical) remains of this behavior. These remains can include anything from prehistoric hand axes, to Egyptian mummies, to First World War trenches, and even more recent material. By rigorously studying these physical remains, we aim to understand (or interpret) more about the past and the circumstances of the people who left them.

For those of us who study very ancient, extinct societies, it is only the durable, long-surviving remains of ancient behavior that survive for the archaeologist to study, artifacts such as stone tools, clay pots, and house foundations. Food remains, broken animal bones, and plant remains allow us to study how people lived in the past. Sometimes we are lucky, especially in cold, dry, or wet environments, and more perishable objects such as wooden artifacts or delicate jewelry, even fiber sandals, survive. The spectacular contents of the Egyptian pharaoh Tutankhamun's tomb are an example of exceptional preservation conditions (see [Figure 4.7](#) on page 70).

The term “archaeology” comes from the Greek *arkaaios*, “ancient,” and

logos, “word.” It goes back to at least A.D. 1600, when it referred to the study of antiquities generally. As we’ll see in [Chapter 2](#), archaeology as a science developed out of the antiquities collecting, then came to refer to the study of ancient history as a whole. Today, the definition has narrowed still further to the study of material remains and human cultures using archaeological method and theory, the subject of this book.

The human cultural past spans over 3.3 million years, with the immediate biological ancestry of humanity going back at least another 3 million years before that. Inevitably, then, archaeologists work with researchers from other disciplines, quite apart from using all manner of sophisticated scientific methods to study ancient human behavior. This raises a fundamental question about our study of the human past: Who, exactly, *are* archaeologists? Are they anthropologists or historians? To some extent, it depends where you live.

Are We Anthropologists?

In many parts of the world, archaeology has a close relationship with **anthropology**, the scientific study of humanity in the broadest possible sense. Anthropologists study human beings as biological organisms with a unique characteristic—culture. They carry out research on human development, both biological and cultural, from the very earliest times to today. This enormous field is briefly outlined in the following Doing Archaeology box.

“Archaeology is anthropology” has been a mantra for American archaeologists since the nineteenth century. Why? Because the study of the pre-Columbian past is that of ancient Native Americans, whose traditional societies were the subject of intense scrutiny by early anthropologists like Franz Boas, Alfred Kroeber, and Frederica de Laguna, to mention only a few. Archaeologists have long made use of analogies (comparisons) between their findings and Indian societies, so the close relationship between archaeologists and anthropologists has continued to flourish. For this reason, many archaeologists are to be found in departments of anthropology. There are relatively few stand-alone archaeology departments in the Americas. Archaeology and anthropology also have a close relationship in many other parts of the

world, notably parts of Africa, Australia, and the Pacific, where archaeology, anthropology, and oral histories (which have limited time depth) offer the only way of reconstructing history before the arrival of Europeans.

Many of the archaeologist's objectives are the same as those of the cultural anthropologist. For example, archaeologist Payson Sheets has excavated an ancient Maya village at Cerén in El Salvador that was buried in ash by a volcanic eruption in about A.D. 580. His excavations have revealed a Maya settlement so well preserved that he has recovered maize in the gardens around houses and tools that were stored in the rafters of the dwellings (Sheets, 1992; see [Figure 4.10](#) page 75). Sheets and his colleagues are studying this long-forgotten community and its people by using the material remains of their lives, for, unlike ethnologists, they cannot talk to their subjects.

One could describe an archaeologist as a special type of anthropologist, one who studies the past. This definition is somewhat inadequate, however, for archaeologists use many theoretical frameworks to link their excavated evidence to actual human behavior, and do far more than merely use data different from that used by cultural anthropologists.

Doing Archaeology Spotlight on Anthropology

Anthropology is the study of humanity in its broadest sense. This vast subject can be broken down into three main (and often overlapping) disciplines of biological anthropology, cultural anthropology, and archaeology.

- *Physical (or biological) anthropology* involves the study of human biological evolution and the variations among different living human populations. It is very concerned with physiology and anatomy. Biological anthropologists also study the behavior of other living primates, such as the chimpanzee and the gorilla, and this research can suggest explanations for behavior among the earliest human beings.
- *Cultural (or social) anthropology* deals with the analysis of human social life. It is primarily a study of human culture (or human behavior) and how cultures adapt to the environment.

Some major areas of interest are kinship, politics, religion, economics, linguistics, art, music, and medical anthropology. Cultural anthropologists normally work with living people and tend to collect their data through participant observation, interviews, questionnaires, and so on. Much human behavior is, of course, transitory—gestures, speech, and so on—and here anthropologists have the edge on archaeologists (since these elements are obviously not preserved in the material record).

- *Ethnography* (from *ethnos* meaning “folk or people,” and *grapho* meaning “to write”) is the researcher’s record of the people being studied. Ethnographic research may cover every feasible aspect of the people under study.
- *Ethnology* entails comparative studies of societies, a process that involves attempts to reconstruct general principles of human behavior.
- *Archaeology* is the study of past human experience primarily via our material culture. It draws on methods and theories of cultural anthropology (particularly when attempting to interpret the archaeological data), but has its own rigorous, often highly scientific, ways of recording the material being studied, as this book shall highlight.

In many ways, the archaeological subdiscipline of **ethnoarchaeology** is perhaps closest to cultural anthropology (or specifically, ethnography) in its approach. One of the most difficult tasks for the archaeologist is to know how to interpret the material remains in human terms. Ethnoarcheologists, like ethnographers, spend time living among contemporary communities; however, their prime aim is to understand how the people use their material culture (the stuff of archaeology)—how they make their tools, wear their jewelry, divide their living space, build their homes and so on. They hope to use their findings to assist in the interpretation of the archaeological record.

Physical anthropologists play important roles in the study of ancient societies, for their work encompasses all aspects of human biology, including skeletal remains, and a cutting-edge field, the study of ancient DNA (see [Chapter 16](#)).

Are We Historians?

Both archaeologists and historians study the human past. Historians focus on documentary sources—primarily written records (but also maps, films, and other such documents). In contrast, archaeologists draw on all material remains, and since documentary records are one subset of material remains, then in answer to the earlier question—yes, we are (and then some!).

In Europe, the Middle East, India, and many parts of Asia, historical continuity links past and present, without the disruptive effects of recent colonization. This makes for long historical chronicles, where written records of people and events extend back thousands of years into the remote past. In the case of Egypt and Mesopotamia, writing began some 5,100 years ago. Britain and France come into recorded history with the Romans about 2,000 years ago. We know the names of monarchs and warriors, details of religious beliefs, and powerful deities. The historical records make for close links between archaeology and history in these areas. (Note: Those who specialize in the study of ancient inscriptions are known as **epigraphers**—a field that obviously has close links to archaeology.)

In countries with long traditions of writing, archaeologists are assumed to be studying what many call “us”—thanks to these shared written traditions. Conversely, in countries without (deciphered) written records, such as much of the Americas, archaeologists are seen as anthropologists. Here, the study of the past is the study of “them”—nonliterate peoples viewed as having separate cultural trajectories. This “us” and “them” distinction is nonsense, of course, for ultimately all humans have common biological and cultural roots and, in the final analysis, we share a common ancestry. What differs are the ways in which we study it, which results from the diverse ways in which the evidence comes down to us—from written documents, to pot fragments, to oral histories, to stone tools, and so on. So archaeology is both part of anthropology and subsumes history.

What Are the Differences Between Archaeology and History?

As we’ve discovered, historians study the past primarily by drawing on documentary (notably written) records. This is where archaeology has

the edge: It not only deals with all material remains, which includes texts (see “document-aided archaeology,” page 9), but it is also our primary source of information for 99 percent of human existence before written history (the era known as prehistory). By contrast, written history describes less than one-tenth of 1 percent of that enormous time span.

Parts of New Guinea and the Amazon basin in South America are still largely outside the scope of written history. Then there are all the countries whose ancient written records remain, obstinately, undecipherable—such as the Indus Valley script of modern Pakistan, a recording system that dates back almost as far as Mesopotamia’s.

Documentary history contrasts sharply with prehistory. First historians, (and those archaeologists studying literate societies) tend to work with accurate chronologies. They can date an event with certainty to within a year, possibly even as closely as to the minute or the second. Second, their history is that of individuals, groups, governments, and even several nations interacting with one another, reacting to events, and struggling for power. They are able to glimpse the subtle interplay of human intellects, for their principal players have often recorded their impressions or deeds on paper. But the historian’s record often has gaps. Details of political events are likely to be far more complete than those of day-to-day existence or the trivia of village life, which often mattered little to contemporary observers. Such minor details of past human behavior, reflected in abandoned artifacts and food remains, come to light in archaeological excavations that can provide astonishing detail on the lives of anonymous, humble folk living in crowded city neighborhoods or on slave plantations (Little, 2006; Orser, 2016).

Archaeologists build theories and apply scientific techniques and theoretical concepts in studying the material remains of human culture (Renfrew and Bahn, 2016; Sharer and Ashmore, 2013; Thomas and Kelly, 2013). They study all of human existence, from the time of the earliest human beings up to the present. To understand what archaeology involves requires some knowledge of the material evidence we examine. As we shall see in [Chapter 4](#), some raw materials survive much longer than others. Stone and clay vessels are nearly indestructible; wood, skin, metals, and bone are much more friable. In most archaeological sites, only the most durable remains of human

material culture are preserved for the archaeologist to study. Any picture of life in ancient times derived from archaeological investigations is likely to be very one-sided. As a result, the unfortunate archaeologist is like a detective fitting together a complicated collection of clues to give a general impression and explanation of prehistoric culture and society. Often, it can be like taking a handful of miscellaneous objects—say, two spark plugs, a fragment of a china cup, a needle, a grindstone, and a candleholder—and trying to reconstruct, on the basis of these objects alone, the culture of the people who made these diverse objects.

Some people think that archaeology is an assortment of techniques, such as accurate recording, precise excavation, and detailed laboratory analysis. This narrow definition, however, deals only with “doing archaeology,” the actual work of recovering data from the soil. Modern archaeology is far more than a combination of techniques. It involves not only recovering, ordering, and describing things from the past but also interpreting the evidence from the earth. In fact, it is an interactive discipline that strikes a balance between practical excavation and description and theoretical interpretation.

Archaeology? Prehistory? What’s the Difference?

In the early days of excavation, archaeology embraced the study of ancient history as a whole, but the word was gradually narrowed to its present definition: the study of all past human experience primarily through the study of our material remains. As archaeological discoveries multiplied and our knowledge of the remote past increased dramatically, archaeology continued to be the generic term for the study of the entire 3.3 million years or more of the human past. Inevitably, however, some more specific terms came into common use during the late nineteenth century and are still used as general labels today.

Prehistory refers to the period of human history extending back *before* (pre) the time of *written documents* (history)—so prehistory is the enormous span of human cultural evolution that extends back at least 3.3 million years. (For those wondering about the date, here the “start” of human culture is linked to the appearance of the first known

stone tools—currently represented by the 3.3-million-year-old Lomekwi 3 assemblage recently found in Kenya, see the Discovery box in [Chapter 11](#), on page 200). The first writing developed in Egypt and Mesopotamia about 5,100 years ago, giving these areas the longest documentary history in the world, even if the earliest thousand years or so provides only sketchy records. Written history began later elsewhere—in South Asia by about 4,000 years ago, perhaps somewhat earlier, in northern China at about the same time. The Romans brought written records to Europe; Columbus and other European visitors introduced continual written records to the Americas, where the Maya and Aztec of Mesoamerica had used their own written scripts for many centuries. In sub-Saharan Africa, the earliest written chronicles in many places date to the nineteenth century A.D. Elsewhere in Africa, writing has a far more ancient heritage—Egyptians were writing around 5,100 years ago, while the first Ethiopian texts date to around 3,000 years ago. Obviously, prehistory passes insensibly into historic eras at different times depending on when the people begin to leave written records.

DISCOVERY THE JAMESTOWN SETTLEMENT, 1607

In 1607, a small band of adventurers under the sponsorship of the Virginia Company founded the first lasting English settlement in the Americas at Jamestown in Chesapeake Bay. By 1619, the settlers over a wide area of Virginia had elected their first assembly, a year before the Pilgrims arrived at Plymouth in what was to become Massachusetts. The historical records of the early years of the colony are, at best, ambiguous, but they chronicle social unrest, warfare with the local Indians, and problems with hunger and good water supplies. The introduction of Caribbean tobacco by John Rolfe in 1613 provided the cash crop that ensured the survival of the colony. Jamestown's importance eroded as tobacco plantations thrived in the interior. The settlement was abandoned when the state capital moved to nearby Williamsburg in 1699. The site of the original settlement was forgotten and assumed to have vanished under the flooded James River.

With inadequate historical records, the National Park Service turned to archaeology in 1955, on the occasion of the 350th anniversary of the settlement (Kelso, 2006). The excavations located a number of seventeenth-century brick structures, ditches, trash heaps, and wells,

but not the old fort site, which was still thought to be underwater. A half-century later, in 1994, the Association for the Preservation of Virginia Antiquities decided to search once more for the lost settlement. Archaeologist William Kelso undertook the project, basing his work on existing excavations, maps and other records, and a hunch that the site had survived on dry land. He was fortunate that the land had reverted to agriculture after abandonment, so there was no modern town atop the location. Kelso decided to dig near the church, on the grounds that sacred places do not shift, that worship there was continuous, even if different churches had risen on the same site. There were also finds of seventeenth-century artifacts in the same general location, which lay near a Confederate earthwork from the Civil War.

The 1994 season yielded telltale stains of a large, heavy wooden palisade, as well as more seventeenth-century artifacts. Pipe fragments and other artifacts from the palisade post backfill appeared to date the structure to the time of the 1607 fort. The excavation, conducted in 10-foot (3-meter) squares, later revealed a curved trench with accompanying ditch, ending abruptly in what must have been a gate location. By 1996, Kelso was certain that he had located the long-lost Jamestown fort of 1607 ([Figure 1.3](#)).

Like all historical archaeology, the excavation was a complex jigsaw puzzle of artifacts, structures, and historical records. Kelso unearthed the remains of four buildings inside the fort—a barracks, a quarter, and some row houses. A factory for trading with the Indians lay outside the palisade. Each structure was of strikingly similar design, at first a cellar covered with a crude roof, with larger post-supported buildings added later, protected by thatched roofs covering rectangular buildings. The fill of one cellar contained a coin of King James I of England and Scotland, minted in 1606–1607, conclusive proof that the buildings dated to the time of the original fort. The architecture was a form of construction known as “mud and stud,” used in Lincolnshire in eastern England at the time. Some of the colonists were from Lincolnshire, including William Laxton, a carpenter. Recent excavations have also revealed the columns of the church in which the Powhatan Indian Pocahontas was married to the English settler John Rolfe in 1614.

The recovery of the Jamestown settlement is one of the most remarkable discoveries of recent years. Kelso also excavated a series of

settler burials, which provided a portrait of some of the people, including facial reconstructions and insights into the mystery surrounding one colonist who died of a gunshot wound.

Figure 1.3 Excavations at Jamestown Fort, Virginia: a pattern of postholes, also the cellar and pit complex forming part of the barracks.

Source: With permission from Courtesy Preservation Virginia.

Document-aided archaeology is archaeology amplified by written records. Such records can take many forms—Egyptian or Maya **hieroglyphs**, wedge-like **cuneiform** script punched onto clay tablets; Roman records written on scrolls or wax tablets; or medieval parchments. These stand quite apart from the voluminous archives of, say, colonial North America or nineteenth-century European cities. This type of archaeology requires close collaboration between archaeologists and historians, for the former can often provide important and fine-grained detail about humble and illiterate members of society, who are largely invisible in documents. For example, excavations at Jamestown, Virginia, have produced fascinating details about early colonial life (see the accompanying Discovery box).

Are We Scientists?

Since archaeology aims to understand human behavior, it is in this respect a humanity. However, it also draws heavily on scientific methods and research—including the use of cutting-edge equipment on site (see [Chapter 8](#)), microscopic analysis of the finds (see [Chapter 11](#)), and the scientific dating of ancient material (see [Chapter 7](#)), to name just three technical methods within archaeological science. Archaeologists' analytical methods tend to be those of the scientist, too: We collect the data, conduct experiments, formulate hypothesis, and draw a concluding model. Thus, though archaeology may often be taught within arts departments, we can be both artists or scientists, or both.

Who Are the Archaeologists?

No one knows how many archaeologists there are in the world, but

there are many thousands of us, far more than there were even 50 years ago. Until World War II, the international archaeological community was small, filled with gossip, and often plagued with nasty infighting. There were few professional jobs in archaeology. Many leading archaeologists had private means or had wealthy patrons. Howard Carter, who discovered Tutankhamun's tomb in 1922, worked with the financial support of Lord Herbert Carnarvon, an aristocrat with impeccable taste in art, a passion for horse racing, and unlimited resources. In the early twentieth century, wealthy philanthropists mounted large archaeological expeditions in the American Southwest. Englishman Alexander Keiller provided years of support for excavation around the stone circles at Avebury in southern England, dating to about 2500 B.C. A strong tradition of private support continues to this day, especially for field research in areas such as Egypt, the classical lands, and Mesoamerica.

Inevitably, archaeology was seen, with some justification, as a pastime for leisured, wealthy folk prior to World War II. Even major excavations with multiple field seasons were remarkably casual. The British archaeologist Leonard Woolley, accompanied by T. E. Lawrence, famous for his "Lawrence of Arabia" exploits but actually a gifted pottery scholar, excavated the Roman and Hittite city of Carchemish, located at a strategic crossing of the Euphrates River, just before World War I. The two of them, assisted by Sheikh Hamoudi, a strict foreman, whose interests in life were said to be archaeology and violence, excavated on a large scale with dozens of laborers. Volleys of rifle fire greeted important finds, for Woolley considered the Carchemish excavations "a great game," a far cry from Egypt, where digging had become what he called "a mere business." Woolley and Lawrence lived in a mud-brick house in great style, going armed at all times. The locals were quite capable of raiding the dig without notice. The excavations at Carchemish, and many other places, as recently as three-quarters of a century ago, had an Indiana Jones-like quality that still colors highly inaccurate public perceptions of archaeology.

As recently as the 1960s, almost all archaeology was purely academic, with most field research being in the hands of university scholars and museum researchers. However, archaeology had begun to change after World War II when the number of professional

archaeologists increased dramatically, not only in Europe, the Mediterranean, and North America but throughout the world. At the same time, archaeology itself became a rigorous academic discipline and a profession with a new international perspective. With many more archaeologists and a far wider range of sites being investigated, the field has become ever more specialized, as well as becoming both a purely academic discipline and a profession with an important role in the contemporary world. As numerous examples in this book will testify, much archaeology is now carried out not on excavations, although, obviously, digging is a major component of our work, but indoors. Work in the field often spills over into science laboratories. Three thousand years ago, Chavín de Huantar was an important shrine in the foothills of the Peruvian Andes. It had a semisubterranean maze of tunnels and water courses, for many of the public rituals surrounded water, a major element in Andean beliefs. During rainstorms, flowing water resonated through the temple defiles with impressive sound effects. We now know that the shrine's priests amplified these effects with conch shell trumpets—seashells imported from the Ecuadorian coast, then modified into musical instruments. Twenty such trumpets came to light at Chavín in 2001. Now acoustic specialists have recorded the sounds played by a trumpeter in the heart of the temple and replicated truly eerie sound effects that added to the mystique of the sunken chambers and passages. Three thousand years ago, as today, sound played a central role in public ceremonies. Other experiments have revealed the remarkable acoustic qualities of Maya pyramids and plazas, as well as ball courts, places where a priest or ruler could be heard by thousands of people, without the use of microphones.

[Figure 1.4 CRM excavation in an urban setting. Backhoe trenches expose pit houses and the village plaza at the Valencia Viejo site, Phoenix, Arizona, a Hohokam village founded around A.D. 425.](#)

Source: Brian Fagan.

By the same token, more and more archaeology in all parts of the world comes about because of the need to preserve archaeological sites, the archives of the past, in the face of industrial activity of all kinds. Such field and laboratory work, called **cultural resource management**

(CRM) in North America, is part of legally mandated efforts to conserve the priceless records of the past for future generations. Increasing numbers of archaeologists are also involved in issues of cultural heritage, which includes cultural tourism, one of the fastest-growing segments of global travel. It's tempting to make a distinction between purely academic and what one might loosely call "applied archaeology," but, like all such subdivisions, the one passes into the other. Many academic archaeologists carry out their work as part of multiple CRM projects within a restricted area. For years, archaeologists working around Phoenix and Tucson, Arizona, have been studying agriculture and irrigation centered on major river valleys. An important volume has recently summarized the 1,000-year-old history of the Hohokam people, between about A.D. 450 and 1450. The Hohokam were water managers, but our knowledge of their expertise would be very incomplete if it was not for years of CRM activity (Fish and Fish, 2007) (Figure 1.4).

Who, then, are the archaeologists? There's no such thing as a "typical" archeologist, for the field is now dauntingly specialized. Apart from the basic distinction between academic and nonacademic, and that's largely artificial these days, we all share the same basic objectives, summarized next (see pages 23 to 25). Academic archaeologists carry out basic research and have an obligation to publish their work, epitomized by the well-known publish-or-perish syndrome imposed by research universities. Archaeologists in the CRM world have obligations to complete their contracts on time to comply with federal and state law. Both academic and nonacademic archaeologists are, or work with, specialists. During our careers, we've worked with all kinds of specialists, in everything from gold metallurgy and (yes) Ice Age earthworms, to experts on tree rings, furrow irrigation, and Islamic architecture—to mention only a few. All we can do here is briefly describe a few major specific approaches, many of which involve both academic and applied research.

During the 1940s and 1950s, the number of female archaeologists increased gradually, including such pioneers as Kathleen Kenyon, who excavated the earliest farming settlements at Jericho between 1952 and 1958. Among a growing number of women in American archaeology, Tatiana Proskouriakoff trained as an architect but became entranced

with the Maya. She devoted her career to Maya glyphs and created superb reconstructions of key Maya structures.

These days, archaeologists tend to define themselves according to their own specific specialization. This may relate to the era they study (e.g., prehistory or medieval archaeology) or according to their geographic area (e.g., Yemen or Peru). Some archaeologists have trained in key specialties that can be applied to many areas or eras—such as lithic or bone specialists. Others may be government employees tasked with looking after material from all periods but within a specific region. Others still may be professional diggers who move from site to site depending on where work is available. (In the United Kingdom, such people are known as “circuit diggers.”) Here is a taster of some of the main areas of interest.

Figure 1.5 The Parthenon in Athens, Greece. Recent classical research pays close attention to the economic, political, and social contexts of ancient architecture.

Source: Courtesy of Fotolia.

Prehistoric archaeologists (prehistorians) study prehistoric times, from the time of the earliest human beings up to the frontiers of documentary history. Since prehistorians deal with such a vast timescale, their dozens of specialties include **paleoanthropology**, which is studied by experts in the culture and artifacts of the earliest human beings. Other prehistorians are authorities in stone technology, studying the early peopling of the world and the lifeways of prehistoric hunter-gatherers. Those who specialize in the origins of agriculture and literate civilization work with pottery, domesticated grains, animal bones, and a wide range of site types and economic lifeways.

Classical archaeology is the study of the remains of the great classical civilizations of Greece and Rome (**Figure 1.5**). Traditionally, classical archaeologists have paid much attention to art objects and buildings, but many are now beginning to study the types of economic, settlement, and social problems of interest to prehistoric archaeologists that are discussed in this book (Snodgrass, 1987; Soren and James, 1988).

Egyptologists and **Assyriologists** are among the many specialists who work on specific civilizations or time periods. These specialties require unusual skills. Egyptologists must acquire a fluent knowledge of

hieroglyphs to help them study the ancient Egyptians, and Assyriologists, experts on the Assyrians of ancient Iraq, must be conversant with cuneiform script.

Historical (text-aided) archaeology is the study of archaeological sites from periods for which written records exist. Historical archaeologists examine medieval cities, such as Winchester and York in England; they excavate colonial American settlements (see [Figure 1.6](#)), Spanish missions, and nineteenth-century forts in the American West; and they study a range of historical artifacts, from bottles to uniform buttons (Little, 2006; Orser, 2016). In recent years, much historical archaeology has been concerned with the study of the African diaspora.

Historical archaeology is concerned with the study of ancient material culture, for artifacts and technology can tell us a great deal about the diversity of historic societies. A classic example is William Kelso's discovery of the original Jamestown settlement of 1607, which everyone assumed had been washed into the James River until Kelso discovered the foundations of its houses and palisade by excavation (Kelso, 2006). (See the Discovery box on page 8.)

[Figure 1.6 Recovering an amphora from the Bronze Age shipwreck at Uluburun, off southern Turkey. The ship, dating from the fourteenth century B.C., contained objects from all over eastern Mediterranean lands, testifying to the broad reach of international trade at the time.](#)

Source: Courtesy of DEA/M. Seemuller/De Agostini/Getty Images.

People of the Past Early Female Archaeologists

Sophia Schliemann, wife of Heinrich, worked alongside him at Hissarlik and Mycenae. Amelia Edwards traveled the Nile and became a passionate advocate for preserving Egypt's past. Flinders Petrie's wife Hilda ran his camps (and his life) with an iron hand in the field and out. Women played an inconspicuous but important role in the male-dominated world of nineteenth-century archaeology. Many of their successors became important archaeologists in their own right, overcoming generations of male prejudice. Among them are the following.

The redoubtable Englishwoman Gertrude Bell (1868–1926) was one of

the first women to graduate from Oxford. In 1899, she traveled to Jerusalem and then to Petra, falling in love with archaeology and desert travel in the process. At first she worked on Byzantine ruins, then set off in 1909 alone across the Syrian desert to the Euphrates River, a dangerous, unheard-of journey for a woman. There, she surveyed the walled Islamic palace of Ukhaidir. By 1914, she was a respected archaeologist and desert traveler, whose expertise in tribal politics played an important role in the founding of Iraq. She was also the founder of the Iraq Museum. Bell was a formidable woman, always smartly dressed, who did not suffer fools. She insisted on retaining many foreign excavators' finds for Iraq, a precedent-setting trend in the 1920s.

Figure 1.1a Gertrude Bell at Ukhaidir, Iraq.

Source: Courtesy of Pictures from History/Bridgeman Images.

During the Balkan War of 1897, Harriet Hawes (1871–1945) nursed Greek soldiers; she also ran a field hospital for Serbian soldiers in World War I, traveled through Crete on a mule looking for sites, and excavated the Minoan town of Gournia, all before she was 35 years old. Hawes went to Athens in 1896 to study at the British School of Archaeology, but ended up working at a Greek field hospital. Returning on Yale fellowship to study inscriptions, she was told excavation was “men’s work.” She went to Crete instead. A peasant led her to Gournia Bay, where she worked almost alone, supervising over a hundred workers. Three years of digging revealed 3 acres (1.2 ha) of a Minoan town and 80 dwellings. Hawes devoted the rest of her life to teaching at Wellesley College and to social activism.

Gertrude Caton-Thompson (1888–1985) graduated from Cambridge University and learned excavation in Egypt. From 1924 to 1926, she worked in the Fayum Depression west of the Nile, where she found a simple farming village dating to about 4000 B.C. , at the time the earliest in the world. A tough, no-nonsense excavator, Caton-Thompson was commissioned to dig at Great Zimbabwe in southern Africa in 1929 (see [Figure 7.13](#) on page 116), where she used imported objects to show that the imposing site was the work of Africans rather than a rumored palace of the Queen of Sheba.

The career of Dorothy Garrod (1892–1969), who studied Stone Age archaeology at Cambridge University, was devoted to excavations on prehistoric sites, mainly in southwestern Asia. She excavated Stone Age caves on Mount Carmel, where she found Neanderthal remains and a long sequence of human occupation. Her Mount Carmel finds led her to believe that modern humans had originated outside Europe, not a popular viewpoint at the time. She was elected professor of archaeology at Cambridge University in 1939 at a time when women were still not full members of the university; she was the first female professor ever appointed there. Garrod was one of the pioneers of world prehistory.

Figure 1.1b Harriet Hawes.

Source: Courtesy of Science Source.

Mary Leakey (1913–1996) was already a trained archaeologist and draughts-woman when she married Louis Leakey in 1936. For the next half-century, the cigar-smoking Mary worked both alongside her husband and alone on archaeological sites of all kinds throughout East Africa. She found *Zinjanthropus boisei* at Olduvai Gorge in 1959, also the 3.5 million-year-old hominin footprints at Laetoli, Tanzania (see [Figure 0.1](#), page 2), as well as making important discoveries of early rock art and farming villages.

Figure 1.1c Dorothy Garrod.

Source: Courtesy of Archive PL/Alamy Stock Photo.

A surprising number of women were actively involved in American archaeology long before it became commonplace, among them Marjorie Ferguson Lambert (1908–2006), who was introduced to Southwestern archaeology by pioneer excavator Edgar Hewitt and enrolled in his new graduate program at the University of New Mexico. She subsequently excavated a late historic pueblo at Pa'ako Pueblo near Albuquerque; during this time she had 45 males working for her. One of her most notable discoveries was a hunting net made of human hair, which was recovered deep in a cave near the Mexico border.

Marie Wormington (1914–1994) studied at Denver University and later learned Stone Age archaeology in France. In 1937, Wormington

was appointed curator of archaeology at the Denver Museum of Natural History, where she remained until 1968. Wormington was a pioneer researcher of Paleo-Indian sites in the west and an expert on stone projectile points; she was also the first female archaeology PhD to graduate from Harvard University.

Figure 1.1d Mary Leakey working on the hominin footprints at Laetoli, Tanzania.

Source: Courtesy of Science Source.

Much text-aided archaeology is a multidisciplinary enterprise; an example is the long-term research projects conducted in the historic district of Annapolis, Maryland. The excavations in the city have investigated a tavern, eighteenth-century residences, and many other sites, including a lot now occupied by a modern hotel. This property has yielded bottles, cups, and plates dating to about 1690, when the site was first occupied (Yentsch, 1994). The archaeologists revealed intricate layers of occupation, including a timber house of the early 1700s. Governor Calvert's brick house, the first floor of which now forms part of the modern hotel, was subsequently built on the same site in the 1720s. Most of this structure was drastically rebuilt in the nineteenth century, but the walls were preserved within the Victorian building. The excavations also revealed a brick heating system for channeling hot air to a greenhouse. This was partly torn up in the 1760s and filled with domestic refuse before being covered over by an addition to the 1720 house. The refuse proved a rich treasure trove for the archaeologist; it included bones, pins, buttons, hair, pieces of paper, cloth, and fish scales.

Anne Yentsch's Calvert House investigations are important because she attempted to move past the study of mere artifacts to the study of the complex culture in the house, where rich and poor, free and enslaved, men and women, lived in close juxtaposition. European cities, such as Winchester and York, offer magnificent opportunities to combine historical records such as title deeds with excavations, making it possible to identify the owners of individual medieval houses (Keene, 1985).

Historical records can also be important in telling us about societies

that had limited written records. Classic Maya civilization, which flourished in Mesoamerica between about A.D. 200 and 900, had developed a complex writing system. With it, the Maya could record religious, political, and astronomical events with elaborate glyphs sculpted on stone and wood and set down in large books. Although still only partly deciphered, these records are revealing the hitherto unknown political history of the Maya (Schele and Freidel, 1990; Schele and Miller, 1992).

Bioarchaeology, the study of ancient human behavior and pathology through biological data, such as human bones, isotopes, and DNA, is assuming a central role in today's archaeology. The study of mitochondrial DNA, inherited through the female line, has thrown new light on such complex issues as the origins and spread of the first modern humans and on the first settlement of the Americas over 15,000 years ago. There are numerous other subspecialties, some of which are defined later in the chapter.

Underwater archaeology is the study of sites and ancient shipwrecks on the seafloor and lake bottoms, even sunken fur-trading canoes capsized by rapids in Minnesota streams (Bass, 1988, 2005; Gould, 2000). Scuba-diving archaeologists have an array of specialist techniques for recording and excavating these underwater sites. There is a tendency to think of underwater archaeology as being merely concerned with shipwrecks and inundated settlements, but in fact it is not. The objectives of such archaeology remain the same: the reconstruction and interpretation of past cultures and the scientific study, through material remains, of all aspects of ancient human endeavor, in this case, seafaring. Some modern underwater excavations, such as the investigation of the Bronze Age Uluburun ship off southern Turkey and the reconstruction of the Kyrenia ship from northern Cyprus, are superb examples of scientific archaeology (Steffy, 1994). The Uluburun ship's cargo included valuable artifacts and commodities, including copper and tin, from many areas of the eastern Mediterranean—a priceless archive of land-based and maritime trade 3,000 years ago.

Biblical archaeology is the study of the archaeology of a variety of ethnic groups living in Syro-Palestine, linking accounts in the Bible and Canaanite literature with archaeological sites in southwestern Asia.

This complex specialization requires a detailed knowledge not only of history and several languages but also of archaeology (Isbouts, 2016).

Industrial archaeologists study buildings and other structures dating to the Industrial Revolution or later, such as Victorian railway stations, old cotton plantations, windmills, and even slum housing in England (Palmer and Neaverson, 1998). Anyone entering this field needs at least some training as an architectural historian.

Forensic archaeology is a new form of forensic science that uses techniques developed within archaeology within a legal context (predominately medicolegal). Typically working in conjunction with police departments, forensic archaeologists have been involved in the recovery and interpretation of murder victims and have also helped to identify individuals within mass burials, such as in Rwanda and the former Yugoslavia (see [Chapter 19](#)).

CRM archaeologists spend their careers working on a multitude of different CRM projects. Some of these are on an enormous scale, involving multiyear surveys, excavations, and lengthy laboratory research. CRM archaeology involves many skills that are outside the normal domain of academic specialists, such as cultural law, knowledge of federal and state regulations, and other basic management skills. However, all of them have basic academic training in some specialization within the field, as well as practical experience of excavation, survey, and artifact analysis. Increasingly, major research projects, such as the Hohokam projects mentioned earlier, are coming from CRM field and laboratory work. Given the cost and time constraints involved, CRM archaeologists have pioneered both multidisciplinary research and the use of sophisticated electronic survey and site-mapping methods.

Today's archaeology is profoundly concerned with people and their behavior. It variously draws on anthropology and history, and is a complex multidisciplinary science. It is also highly specialized, so much so that many archaeologists spend their entire careers studying small areas, a certain type of artifact, animal bones, or some other aspect of ancient human activity. Some of the information that comes from these researchers is fascinating, for example, the medical histories from the bodies of Egyptian pharaohs, such as Rameses II, or the enormous distances traveled by highly prized volcanic glass in the southwestern

Pacific 3,500 years ago. Much of this research is dauntingly technical and relatively inaccessible to laypeople. There's a real danger that future generations of archaeologists, preoccupied with small trenches or minute specialties, will lose sight of the broad sweep of human history from its beginnings over 3 million years ago up to today. We have to remember that we have much to learn from the past that's relevant to today's world and to the future. And this raises another fundamental question.

Why Study Archaeology?

Archaeology seems irresistible—lost civilizations, lavish royal burials, buried cities, and ape-like human ancestors. Strip away the aura of romance and you find that only a few archaeologists are fortunate enough to discover a royal burial or a forgotten civilization. That said, many do come to regard archaeology as a vocation: The discovery of a simple piece of pottery complete with ancient thumbprint or a delicately made stone tool can still be an unforgettable thrill. On the other hand, many expert researchers rarely set foot outside a laboratory. We often spend our careers not looking for the spectacular, but researching the prosaic. Today's archaeologist is as interested in why people lived the way they did, as in the objects they made, and the buildings they erected. Above all, we are concerned with how human societies changed over long periods of time and why. How and why, for example, did civilization develop in northern China? What were the reasons for the partial collapse of much of Classic Maya civilization in the tenth century A.D. ? These questions are just as engaging as the contents of Tutankhamun's tomb—and tell us a great deal about entire ancient societies as well.

However, if you strip away the romantic and spectacular, the question remains: Why study the remote past? On the face of it, the study of archaeology, however fascinating, seems a luxury we can ill afford in a world beset by economic uncertainties, uncontrolled global warming, wars, and widespread poverty and famine. But to regard archaeology in such a way would be to treat the entire cultural heritage of humanity as irrelevant and unnecessary to the quality of our lives; in reality, it is integral, as we shall see (Layton, 1994; Trigger, 2006).

Archaeology Is Fascinating

The great public fascination with archaeology began with the classic archaeological discoveries of the nineteenth century, with the finding of the biblical Assyrians of Mesopotamia (see [Figure 1.6](#)) and ancient Troy. Today, archaeology is as much a part of popular culture as football or Facebook. Millions of people visit museums, thousands of people read archaeology books for entertainment, join archaeological societies, and flock to popular lectures on the past. Discoveries such as the spectacular Sipán burials in Peru (Alva and Donnan, 1993; [Figure 6.4](#)) and the Stone Age rock paintings of Grotte de Chauvet in France make front-page headlines around the world (see the Doing Archaeology box on page 347).

Armchair archaeology is one thing; to experience the past firsthand is another. The monuments of antiquity cast an irresistible spell. Cruise ships, the jetliner, and the package tour have made archaeological tourism big business. Fifty years ago only the wealthy and privileged could take a tour up the Nile, visit classical Greek temples, and explore Maya civilization. Now package tours can take you to Egypt, the Parthenon, and Teotihuacán, Mexico (see [Figure 15.14](#) on page 301). The immense Pyramids of Giza in Egypt (see [Figure 16.7](#) on page 323), the ruins at Tikal in Guatemala (see [Figure 15.3](#) on page 291) bathed in the full moon's light—as sights alone, these overwhelm the senses. To sit in the great amphitheater at Epidaurus, Greece, and to hear Euripides's stanzas recited in the perfect acoustics of the highest seats is a deeply moving experience. Tutankhamun's golden sarcophagus or a giant Olmec head with snarling face (see [Figure 17.7](#) on page 352) lifts us to a realm where achievement endures and perceptions seem of a higher order. There are moments when the remote past reaches out to us, comforting, encouraging, offering precedent for human existence. We marvel at the achievements of the ancients, at their awesome legacy to all humankind.

[Figure 1.7](#) English archaeologist Austen Henry Layard's workers lower a winged bull from the Assyrian palaces at Nimrud, Iraq.

Source: Courtesy of Susan Einstein/UCLA Fowler Museum of Cultural History.

DISCOVERY LIANGZHU: CIVILIZATION AND WATER MANAGEMENT IN SOUTHERN CHINA, 2007–

Between 3300 and 2300 B.C. , a remarkable rice-farming society arose in a fertile basin surrounded by mountains along the lower reaches of the Yangtze River in southern China—at about the same latitude as the well-known early civilizations of the western Asian and eastern Mediterranean world. The well-watered basin with fertile soils is scattered with lakes and crossed by unobstructed rivers as well as the Yangtze, making it ideal for rice cultivation, which began before 8000 B.C. Liangzhu city, which was first discovered in 2007, came into being in a C-shaped basin in about 3000 B.C. , a city with three enclosures (Renfrew and Liu, 2018). An inner-city wall encloses 741 acres (300 ha) that protects a palace enclosure of 30 acres (74 ha). The outer city district covers 1,976 acres (800 ha), making it equivalent in scale to many early cities in the West. Three layers of walls and platform-based architecture distinguished the social statuses of the people living in each district. Jade ornaments were used to distinguish social status. Liangzhu, arguably the earliest civilization in China, had a vast suburban district, as well as an astronomical observatory and an elaborate, newly discovered irrigation and water management system. An ongoing large-scale survey and excavation project has revealed a huge enterprise that required the mobilization of huge labor forces and took several centuries to complete. All of these sites, covering an area of about 38.6 miles (100 sq. km), were constructed by hand, using over 495 million cubic feet (8.4 million cu. m) of soil. Core borings reveal that the humanly constructed waterways inside and outside the city had a combined length of 19.6 miles (31.6 km).

The city itself was a rectangle with rounded corners, the outer wall with inner and outer moats on three of its four sides and only an inner one on the fourth. At least two water gates penetrated each side of the walls, which allowed water to flow into the city. There was a solidly built roadway entrance in the southern wall. The interior was carefully planned, with over 51 ancient waterways crisscrossing the city. As the city expanded, many of the smaller waterways were filled in as the population rose. People even built houses atop the walls. The royal

precinct, a massive platform of rammed earth, lay in the center, with the royal mausoleum and artisan's quarters in the northwest. On the outskirts of the city, a series of platforms formed a raised area that encircled the city and formed an outer district. Northwest of the city lay 11 dams that formed part of a network of waterways controlling the water flowing into the basin from nearby mountains. There were two groups of dams at higher and lower elevations. They formed a protective barrier for the city, forming a reservoir that covered 5 sq. miles (13 sq. km). The entire water management complex prevented flood damage; allowed the smooth transportation of goods, including rice from surrounding paddy systems; and provided water both for drinking and for irrigating the fields (Figure 1.8).

The spectacular Liangzhu water management system dates to about 3000 B.C. and is the largest such system in China. Only the Ancient Egyptians constructed equivalent, but smaller, water control dams at such an early date. The Liangzhu dams, reservoirs, and water control networks have come to light from extensive surveys and excavations that have only just begun. Liangzhu is revealing the remarkable skills of ancient engineers, who relied on human hands for their work. This long-term research shows us that not all truly remarkable archaeological discoveries are those of royal burials or other rich finds. They can result from painstaking fieldwork and the investigation of the seemingly unspectacular. The result: the discovery of an almost-forgotten state.

Figure 1.8 Excavations in a water dike at Hangzhou, near Liangzhu, China, 2016.

Source: Courtesy of Xinhua/Alamy Stock Photo.

Archaeology and the Remote Past

The past is not a neutral place, despite our common humanity. Every society on earth has some version of an origin myth—folklore that is accepted as the official, sanctioned account of how the earth and humankind came into being. Western society is no exception: “And God said, ‘Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing

that creepeth on the earth.'” Thus reads the first chapter of Genesis in the biblical Old Testament, a majestic account of the Creation that was accepted as the authorized version of human origins for centuries.

Origin myths, such as that of Genesis, developed in response to humanity’s deep-seated curiosity about its origins. They also reflect each society’s perspective on human existence. For many peoples, existence is defined by their close relationship to the natural world and by the endless cycles of passing seasons. Such definitions assume that human existence is unchanging, that both past and future generations will share the same existence as those alive today. In contrast, Western civilization has a linear view of human existence, depicting it as unfolding in all parts of the world over an enormously long period.

For more than 2,000 years, Westerners have speculated about their ancestry and tried to develop theoretical models to explain their origins. Some of these models are purely philosophical; others are based on archaeological data. Archaeology is fascinating because it enables us to test theoretical models of changing societies: why some people have flourished, others have vanished without a trace, and still others have sunk into obscurity (Trigger, 2006).

Archaeology is unique among the sciences in its ability to study changes in human societies over long periods. It provides a way of studying the collective cultural heritage of humankind. Why are we biologically and culturally diverse? In what ways are we similar or different? When did the great diversity of humanity come into being, and why? What were the spiritual beliefs of earlier human societies? These are fundamental questions about humankind that archaeologists can attempt to answer.

Archaeology is a product of Western science, and, as such, is sometimes considered irrelevant by some non-Western societies that believe profoundly in the cyclical nature of human existence. Many Native Americans consider archaeology unnecessary, even insulting to their ancestors. But the fact remains that it offers the only scientific way of understanding the ancient world and the linear histories of Native American and other societies, many of which came into contact with literate Western civilization only in the past five centuries, during the European Age of Discovery. Before European contact, North American Indian history was not written; it consisted mostly of oral

traditions handed down from generation to generation. Archaeology and archaeological sites are the only other possible sources for very early American Indian history. More and more archaeologists are working closely with American Indian communities (Dongokse et al., 2000). Southwestern groups, among others, have retained archaeologists and anthropologists to work on land-claim cases currently in the courts. The Hopi and Zuni nations, for example, have formed their own archaeology units to investigate sites on their land (Watkins, 2003; see [Chapter 18](#)).

Archaeological excavations reveal much about the diversity of early historic American society. In Florida, Kathleen Deagan has excavated the site of Fort Mose, the first free black community in North America. This tiny hamlet of some 37 families, 2 miles (3.2 km) from Spanish Saint Augustine on the Atlantic coast, was founded in 1738, overrun by the British in 1740, and rebuilt in 1753. A walled fort enclosed a large church, the priest's house, a well, and guardhouses; the villagers lived in 22 thatched houses (see [Figure 1.9](#)). Many of the inhabitants were of West African origin, and excavations have recovered military artifacts and domestic items, offering the prospect that one day archaeologists will be able to identify what African, English, Native American, and Spanish cultural elements the black inhabitants assimilated. Fort Mose was occupied until the Spanish abandoned Florida in 1763 (Deagan, 1995). Other excavations in the South and the Southeast have investigated plantation life and slave communities, a rich archaeological record of very culturally diverse African American populations (Ferguson, 1992).

Archaeology can restore long-vanished history to peoples whose past, handed down from one generation to the next, has vanished because it was never set down in writing. Many recently independent nations, eager to foster nationalism, are encouraging archaeological research as a way to uncover the early roots of the peoples who lived there before colonial times. For years, governments in Africa have sponsored excavations, whose results soon appear in university textbooks and schoolbooks. The primary goal of archaeology there, as in many parts of the world, is to write unwritten history, not from archives and dusty documents but from long-abandoned villages and rubbish heaps (Trigger, 2006).

Figure 1.9 A student excavating at the Fort Mose site, Florida.

Source: Courtesy of James Quine/Alamy Stock Photo.

Archaeology in Today's World

The archaeologist's spade enables us to explore the earliest human campsites over 3 million years ago, to probe the densely occupied layers of late Ice Age caves of 18,000 years ago, and to reconstruct tiny farming villages of 12,000 years before present and crowded urban precincts in nineteenth-century Baltimore. As a result, archaeology is important in a world where living with, and understanding, human diversity has assumed great importance.

We live in an increasingly anonymous world of large cities and multinational corporations, of instant communications and computers of unimaginable power. But we still dwell in a world of diverse people who communicate with one another daily as individuals or groups, often electronically, and frequently over distances that would have seemed impossible even a generation ago. Modern technology gives us the ability to mingle freely with individuals and groups near and far away who would never have entered our lives a century ago. As technology becomes ever more important in the industrial world, so do the people who use and benefit from it. We need a far more sophisticated understanding of human diversity than did the ancient Egyptians, so we have much to learn from the past. Modern humans, *Homo sapiens*, have lived on earth, specifically in Africa, for more than 300,000 years, with the first fully anatomically modern humans (*Homo sapiens sapiens*) appearing around 120,000 years ago. The roots of human biological and cultural diversity go back at least that far. Archaeology provides us with a unique perspective on human diversity that has great value in the modern world, simply because of the sheer variety and depth of information on human relations that is available from the scientific record of the past.

Human diversity has been a powerful political and social reality in society since human experience began. Relationships among people, among groups and individuals, were all-important in the preindustrial world, whether those of a large city such as Aztec Tenochtitlán or a tiny farming village in the Mississippi Valley. Bonds of kin, long-term family

ties, and links to the soil were basic adhesives for ancient societies, to the point that Chinese rulers of 4,000 years ago maintained at least fictional kin ties to their commoner subjects in their role as intermediaries with the ancestors. Eighteenth-century New York and Elizabethan London teemed with Africans and Asians. Imperial Rome was home to people from all parts of the Mediterranean and Asian worlds. Ancient Egypt and Mesopotamian cities were hubs of thriving trade routes that brought strangers from afar to early cities. Even in our urbanized and industrialized world, ties of kin and ancient social mechanisms are still important in many societies, whether in rural villages in highland Peru or among urban poor crowded into city slums in West Africa. Archaeology has vital lessons about human diversity to impart in today's world, where the messages of history are often forgotten.

The role of archaeology today will be examined in more detail in [Chapter 19](#).

Who Owns the Past?

Over the past century, archaeology has become a powerful tool for studying the remote past. Nevertheless, many people question whether science offers a viable interpretation of ancient times (Schmidt and Patterson, 1995).

All societies have an interest in the past. It is always around them, haunting, mystifying, tantalizing, sometimes offering potential lessons for the present and future. The past is important because social life unfolds through time, embedded within a framework of cultural expectations and values. In the high Arctic, Inuit preserve their traditional attitudes, skills, and coping mechanisms in some of the harshest environments on earth. They do so by incorporating the lessons of the past into the present. In many societies, the ancestors are the guardians of the land, which symbolizes present, past, and future. There are many reasons to attempt to preserve an accurate record of the past, and no one, least of all an archaeologist, should assume that she or he is unique in having an interest in the remains of that past (Layton, 1994).

We humans think of, and use, the past in different ways.

Archaeologists tend to claim that they are the only people qualified to reconstruct the early human past. It is true that archaeology is the only method Western science has of studying cultural change through time, but that does not give archaeologists unique authority over the past. In many societies, the past is a valued cultural commodity in ways that are fundamentally different from those of the archaeologist. The transmission of knowledge about the past lies in the hands of respected elders, who take pains to preserve the accuracy of oral traditions. Such traditions are of vital importance and are carefully controlled, for they define and preserve a group's identity from one generation to the next. The past is vested not in science but in household, community, kin groups, and territory. As both Australian Aborigines and Native Americans have stressed, there is often a fundamental incompatibility between Western scientific perspectives on the past and the perspectives of other societies.

Robert Layton (1994) points out that many non-Western societies do not perceive themselves as living in a changeless world. They make a fundamental distinction between the recent past, which lies within living memory, and the more remote past, which came before it. Most ancient human societies were nonliterate, which meant that they transmitted knowledge and history orally, by word of mouth. Many oral histories are mixtures of factual data and parables that communicate moral and political values. But to those who hear them, they are publicly sanctioned history, performed before a critical group, and subject to the critical evaluation of an audience who may have heard the same stories before (Smith, 2002). Oral histories are subject to all kinds of biases. None can claim to be totally objective, no more than archaeology is. Interpretation of the past requires recognition of these biases. Through the reliance on different lines of evidence and the careful evaluation of all the information presented, researchers are able to evaluate the strength of different interpretations.

To the archaeologist, the past is scientific data to be studied with all the rigor of modern science. To many indigenous peoples, the past is highly personalized and the property of the ancestors. Such perspectives are valid alternative versions of history that deserve respect and understanding, for they play a vital role in the creation and reaffirmation of cultural identity. And they raise a fundamental

question that lies behind many Native American objections to archaeological research: What do archaeologists, usually outsiders, have to offer to a cultural group that already has a valid version of their past? Why should archaeologists be permitted to dig up the burial sites of their ancestors and other sacred places or settlements under the guise of studying what is, to the people, a known past? We should never forget that alternative, and often compelling, accounts of ancient times exist, and they play an important role in helping minority groups and others maintain their traditional heritage as it existed before the arrival of the Westerners (Layton, 1994).

Archaeology and Politics

The ownership of the past also brings politics into play. People may use the past to invent what happened in previous times in order to advance their own particular ideological or political ends. This is nothing new. The Aztecs called Tlacaélel the “Woman Snake.” He was the right-hand man of a series of fifteenth-century rulers in highland Mexico, a brilliant diplomat who prevailed on his masters to burn all earlier tribal records. In their place, he concocted a convincing rags-to-riches story, which recounted the Aztecs’ mercurial rise from obscurity to become masters of Mexico, chosen by Huitzilopochtli, the Sun God himself. Tlacaélel was not the first official in history to rewrite the past to serve the present. Assyrian monarchs, Egyptian pharaohs, Chinese rulers, and the Romans unashamedly manipulated the past. In more recent times, archaeology has long been used to foster nationalism and to aid political propaganda. In the 1930s, the Nazis used archaeology to produce “evidence” for the existence of a white master race in Europe. The Roman siege of Masada with its tragic ending has long been a focus for Israeli nationalism, and archaeology has been used to fabricate history for all kinds of European ethnic groups in recent years (Kohl and Fawcett, 1995).

Interpretations of the past are rarely value-neutral (Fowler, 1987; Hodder, 1999). Inevitably, archaeologists bring to their work values and perspectives from their own culture, even though they are more conscious of doing this than they were a generation ago (Shanks and Tilley, 1987a). Such subliminal biases, however, are very different from

the deliberate use of archaeology to establish historical fact and to support claims against governments or nationalist goals, but they still have an effect.

Is Archaeology in Crisis?

The past surrounds us on every side and offers spectacular images of the glories of ancient civilizations and golden treasures almost beyond imagination. Who can fail to be overwhelmed by the sheer size and elaboration of the Temple of Angkor Wat in Cambodia ([Figure 1.10](#)) or the imposing majesty of an ancestral statue (*moia*) on Rapa Nui in the Pacific (see [Chapter 5](#) opener)? We admire, yet we yearn to exploit the past, to use it to explain enduring mysteries, and above all, to own part of it. Such feelings are part and parcel of human behavior, which goes back to Babylonian monarchs and Roman emperors. The surviving remains of the past surround us on every side, but they are frail, easily damaged, and even more easily destroyed. Archaeologists everywhere, working with limited funds and often inadequate legal tools, are fighting to preserve the past for the future, to prevent the destruction of the fine archives of ancient times before it is too late. The fight is an uphill one, involving complex management issues and confrontations with the seemingly inexorable forces of a rapidly expanding industrial world. Archaeology is in crisis, both from looters and industrial development; from those who wish to destroy the past, such as the purposeful, serious destruction of mindless destruction of sites like Palmyra in Syria, and in Yemen. No one, not even area experts, know precisely how much damage has been done in these countries, also in Afghanistan and Iraq. This is an unfolding story that will undoubtedly receive extensive coverage in future editions of this book.

Unexplained Mysteries? Try Pseudoarchaeology

Modern archaeology is highly technical and—let us be honest—sometimes rather dull and deeply involved in trying to preserve sites and artifacts. What’s happened to the romance, the excitement, many people ask? Small regiments of TV producers and writers have stepped into the breach with a veritable tidal wave of what can be called

pseudoarchaeology—documentaries and books that explore everything from the discovery of Noah’s Ark to the impending end of the world according to the Maya calendar (December 21, 2012). Their tales positively drip with romance and excitement, with “unexplained” secrets, lost civilizations, and great temples buried in dense rain forests. The Lost Continent of Atlantis, the Ten Lost Tribes of Israel, Vikings in North America—all provide superb raw material for the armchair adventurer (Feder, 2017). Popular writer Erich von Däniken (1970, 1998) created a notorious pseudoarchaeology by arguing that people from other worlds lived on the earth long before our civilization arose.

Figure 1.10 Angkor Wat, Cambodia, built by King Suryavarman II in A.D. 1113. The building is a replica of the symbolic Hindu world, the highest tower representing the mythic Mount Meru.

Source: Courtesy of Fotolia.

Von Däniken’s brand of pseudoarchaeology is unusual only because he has moved into space for his heroes. Like his predecessors, and like many people fascinated by escapism and space fiction, he is intoxicated with the mystery and lure of vanished tribes and lost cities engulfed in swirling mists (Wauchope, 1972). Of course, not all pseudoarchaeologists turn to space for their explanations. British journalist Graham Hancock (1995) has claimed that a great civilization flourished under Antarctic ice 12,000 years ago. (Of course, its magnificent cities are buried under deep ice sheets, so we cannot excavate them!) Colonists spread to all parts of the world from their Antarctic home, colonizing such well-known sites as Tiwanaku in the Bolivian highlands and building the Sphinx by the banks of the Nile. Hancock weaves an ingenious story by piecing together all manner of controversial geological observations and isolated archaeological finds. He waves aside the obvious archaeologist’s reaction, which asks where traces of these ancient colonies and civilizations are to be found in Egypt and other places. Hancock fervently believes in his far-fetched theory, and being a good popular writer, he has managed to piece together a best-selling book that reads like a “whodunit” written by an amateur sleuth.

This kind of pseudoarchaeology forms a distinctive literary genre in

which the author is the reader's guide behind the pathetic facade put up by science along the path to the Real Historical Truth. Far more insidious are pseudoarchaeologies that masquerade as serious "alternative" histories. Some years ago, linguist Martin Bernal (1987) published a detailed scholarly analysis of Egyptian civilization in which he claimed that this earliest of states, and Western civilization for that matter, owed much to black African inspiration. Bernal's "Black Athena" hypothesis caused a sensation in African American circles and has become an important rallying point for Afrocentrists—historians who believe that Africa was at the center of world history, the fountain not only of humanity but also of civilization itself. According to Egyptologists and others with detailed knowledge of Bernal's linguistic arguments, the entire Black Athena hypothesis is seriously flawed on methodological and historical grounds. Egyptian civilization was an entirely indigenous development within the narrow confines of the Nile Valley below the First Cataract, with only sporadic, usually commercial, contacts with black African kingdoms upstream until very late in Egyptian history.

Whereas von Däniken and Hancock work within a distinctive and escapist literary genre, Bernal's work appeals to very different audiences, to people whose perspectives on history are tied to establishing cultural identities in the modern world.

Unfortunately, popular attitudes toward archaeology tend toward the romantic and the exotic. A public nurtured on television, sound bites, and instant gratification prefers mystical adventure stories of lost civilizations to scientific reality. Therefore, archaeologists often fight an uphill battle to convince a wider audience of the value of their work, even if the magazine *Skeptical Inquirer* regularly debunks the more outrageous pseudoarchaeologies. Today's archaeology may be far from exotic and highly technical, but it is still extremely fascinating. This book will give you an understanding of how scientific archaeologists go about their work and of the ways in which they strive to reconstruct the past.

The archaeologist's perspective contributes not only to an understanding of our own history but also to an understanding of the environment, the world climate, and the landscape. The long-abandoned settlements that archaeologists study are repositories of

precisely dated geological, biological, and environmental data that can add a vital time depth to studies of the contemporary world. Unfortunately, archaeological sites are an “endangered species.” Ancient settlements are being destroyed so rapidly that a sizable portion of the world’s archaeological heritage has already vanished.

Unlike trees or animals, archaeological sites are a finite resource. Once a bulldozer or a treasure hunter moves in, archaeological evidence is destroyed. The archaeologist’s archives are buried in the soil, and the only way to preserve them is to leave them alone, intact, until they can be investigated with rigorous scientific care. Both human nature and the insatiable needs of the world’s growing populations have wrought terrible destruction on the archaeological record everywhere. Pothunters and treasure hunters have left thousands of archaeological sites looking like rabbit burrows and have so damaged them that archaeological inquiry is impossible. The ravages of industrial activity, strip mining, and agriculture have also taken their catastrophic toll on many sites. In many parts of the United States, damage of sites is an uncontrolled epidemic.

Collectors, Looters, and the Morality of Collecting

Our materialistic society greatly emphasizes wealth and the possession of valuable things. Many people feel an urge to possess the past, to keep a piece of antiquity on the mantel. Projectile points, prehistoric hand axes, Egyptian statuettes, or Maya pots add an exotic touch to the prosaic Western living room. Many archaeological artifacts, such as Benin bronzes from West Africa, have high antique and commercial value. They are “buried treasure,” valued as museum pieces and by the world’s major collectors, commanding enormous prices at auctions and in salesrooms. High commercial prices and the human urge to own have incited unscrupulous treasure hunting and a flourishing illegal trade in antiquities, resulting in the rape of sites for gold and other precious ornaments, as well as pottery, sculpture, and other artifacts. In some countries, such as Italy and Costa Rica, tomb robbing is a full-time, if technically illegal, profession. The Italian *tombaroli* (tomb robbers) concentrate on Etruscan tombs (Meyer, 1992). Entire Inca cemeteries in the Andes have been dug up for gold ornaments.

Thousands of Egyptian tombs have been rifled for papyri and statues. Massive looting of ancient cities began immediately after the Iraq War of 2003, while the Baghdad Museum was ravaged as the city fell (Bogdanos and Patrick, 2005). The heritage of Syria and Yemen has also been under serious assault during the ongoing conflicts in both countries. Again, there are reports of widespread illegal looting, along with a heavy dose of “ideological” destruction, for example at the world-famous site of Palmyra, Syria.

Though the deeply troubling stories from the Middle East have dominated the media, looting of a different type continues unabated in the United States, too, despite increasingly comprehensive legislation. In a particularly scandalous episode, an undisturbed late prehistoric site at Slack Farm, close to the Ohio River in Kentucky, was looted by a group of pothunters who paid the landowner a large sum for the right to dig up Indian burials and the valuable grave goods associated with them. It was two months before their nefarious activities were halted, by which time the site was thoroughly turned over. The offenders were never convicted. In the Four Corners region of the American West, undercover investigators from the Bureau of Land Management and the FBI busted a looting ring in the arrest of prominent community members in Blanding, Utah. Two of them subsequently committed suicide. (See also [Chapter 18](#) and Munson et al., 1995.) In recent years, metal detectors have become a scourge of American archaeology, especially on Civil War battlefields, for memorabilia from this period command high prices. In the United Kingdom, an official Portable Antiquities Scheme has co-opted metal detectorists in the service of archaeology on a near-national scale, with significant results (see the Doing Archaeology box on page 150).

Why do people collect antiquities? In 1921, Henri Codet, a French medical doctor, wrote a pioneering dissertation on collecting. He concluded that it has four underlying motives: “The need to possess, the need for spontaneous activity, the impulse to self-advancement, and the tendency to classify things” (Meyer, 1992: 23). Another Frenchman said of collecting: “It is not a pastime but a passion, and often so violent that it is inferior to love or ambition only in the pettiness of its aims” (Meyer, 1992: 67). People collect everything from beer-bottle caps to oil paintings, and collectors consider anything collectible to be portable

and private, and consider it their duty to preserve it. It follows that everything has a market value and can be purchased, the market value depending on the demand for the category of artifact or its rarity or aesthetic appeal (Muensterberger, 1994). The archaeological context of the artifact is often quite unimportant and information about the people who made it usually irrelevant; all that matters is the object itself (see Figure 1.11).

Figure 1.11 Excavations on a farming village at Mezraa Teleilat, Urfa, Turkey. Archaeological excavation is as much about the context of a find as the object itself.

Source: Courtesy of Images & Stories/Alamy Stock Photo.

Protecting antiquities is complex and incredibly difficult, for in the final analysis it involves appealing to people's moral values and requires almost unenforceable legislation that ultimately would take away a potential source of livelihood, however illegal, from thousands of poverty-stricken peasants and more prosperous intermediaries who have some political influence. Most countries have museums, and many have antiquities services and stringent laws controlling the export of archaeological finds—at least in theory. The trouble is that the laws cost a fortune to administer and enforce, and even relatively developed countries such as Mexico are unable to police even the most famous sites. But public opinion in Egypt and other countries shows some pride in their national heritage. It is galling to see the prized sculptures and antiquities of one's past adorning museums in distant capitals. Yet the tide of public opinion cannot stem the collectors' mania or the ruthless policies of some museums. The plundering of choice objects from the Iraq Museum in Baghdad during the last Iraq War showed the extent to which antiquities traffickers will go to obtain their loot. Changing public attitudes, more cautious policies, and a shortage of fine antiquities may slow the traffic, but terrible damage has already been done.

In recent years, some countries, notably Egypt, Italy, and Greece, have been putting pressure on museums in other countries to return looted artifacts. The Metropolitan Museum of Fine Arts in New York has returned the Euphronios Vase, a masterpiece of Greek pottery to

Italy, while the Getty Museum in Los Angeles has reached agreement with the Italian authorities to return some prize artifacts in exchange for some long-term loans.

Yes, archaeology is in crisis. Looting and site destruction in the face of wars, as well as industrial development of all kinds, is assuming ever-greater proportions with no resolution in sight. As Robert McGimsey pointed out many years ago (1972), those of us alive today may be the last to see undisturbed archaeological sites in North America and many other parts of the world. In some parts of the world, his prediction already seems to be coming true.

What Are the Goals of Archaeology?

Whether they concentrate on the most ancient human societies or those of more recent centuries, all archaeologists agree that their fundamental responsibility is to conserve the past for future generations. Their work has five broad goals:

1. Conserving and managing the world's archaeological sites for the future.
2. Studying sites and their contents in a context of time and space to reconstruct and describe long sequences of human culture. This descriptive activity reconstructs culture history.
3. Reconstructing past lifeways.
4. Explaining why cultures change or why cultures remain the same over long periods of time.
5. Understanding sites, artifacts, food remains, and other aspects of the archaeological record and their relation to our contemporary world.

By no means would every archaeologist agree that all five of these objectives are equally valid or, indeed, that they should coexist. In practice, however, each objective usually complements the others, especially when archaeologists design their research to answer specific questions rather than merely dig as a precursor to describing rows of excavated objects.

All archaeologists follow a code of professional ethics—summarized

in the Doing Archaeology box on page 24—when carrying out any form of field or laboratory research.

Stewardship

Stewardship is the fundamental responsibility of all archaeologists—to ensure the conservation and survival of the finite archaeological record of artifacts and sites for posterity. In recent years, the crisis of looting and destruction that threatens archaeology has made this the most pressing and demanding of all archaeological activities—CRM. (For more on stewardship, see [Chapters 18](#) and [19](#).)

Culture History

The expression **culture history** means, quite simply, the description of human cultures extending thousands of years into the past. An archaeologist working on the culture history of an area describes the prehistoric cultures of that region. Culture history is derived from the study of sites and the artifacts and structures in them in a temporal and spatial context. By investigating groups of prehistoric sites and the many artifacts in them, archaeologists can erect local and regional sequences of human cultures that extend over centuries, even millennia (see [Chapters 3](#) and [10](#)). Most of the activity is descriptive, accumulating minute chronological and spatial frameworks of archaeological data as a basis for observing how particular cultures evolved and changed through prehistoric times. Culture history is an essential preliminary to any work on lifeways or cultural process.

Many archaeologists who work on culture history feel inhibited by poor preservation of artifacts and sites about making inferences on the more intangible aspects of human prehistory, such as religion and social organization. They argue that archaeologists can legitimately deal only with the material remains of ancient human behavior. Unfortunately, this rather narrow view of culture history has sent many people off in unproductive directions, into a long and painstaking preoccupation with artifact types and local chronologies that has turned much of archaeology into a glorified type of classification.

Past Lifeways

The study of past lifeways—the ways in which people made their living in the changing environments of the past—has developed into a major goal in recent years. To study artifacts and structures without environmental context gives a one-sided view of humanity and its adaptations to the environment. Studying past lifeways is a multidisciplinary enterprise, reconstructing ancient subsistence patterns from animal bones, carbonized seeds, and other food residues recovered in meticulous excavation. Pollen analysts, soil scientists, and botanists cooperate in looking at archaeological sites in a much wider, multidisciplinary context. The context of such studies is still descriptive archaeology, preoccupied with space and time, but the emphasis is different: It is on changing patterns of human settlement, subsistence strategies, and ancient environments.

Doing Archaeology An Archaeologist's Ethical Responsibilities

Professional archaeologists live by multiple formal and informal codes of ethics that govern the ways they go about their business. The Society for American Archaeology's code is simple and to the point (Lynott and Wylie, 2000; Scarre and Scarre, 2006). It expects professional archaeologists to do the following:

- Practice and promote the stewardship of the archaeological record for the benefit of all people.
- Consult effectively with all groups affected by their work and be sensitive to the values of other cultures.
- Avoid activities that enhance the commercial value of archaeological objects that are not readily available for scientific study or cared for in public institutions.
- Educate the public to enhance public understanding of the past.
- Publish their findings in a widely accessible form.
- Preserve their collections, records, and reports properly, as part of a permanent record of the past for future generations. They must also allow other archaeologists access to their research materials within any legal or other compelling restrictions.
- Never undertake research without adequate training, experience, and facilities to complete the task at hand.

As long ago as 1948, Gordon Willey surveyed in detail the coastal Virú Valley in Peru, where he plotted the distributions of hundreds of prehistoric sites from different chronological periods against the valley's changing environment (Willey, 1953). This was a pioneering attempt at reconstructing prehistoric patterns of settlement, obviously a key part in any attempts to reconstruct prehistoric lifeways.

This goal of archaeology is still descriptive, within a theoretical framework that sees human cultures as complicated, ever-changing systems. These systems interact with one another and with the natural environment as well.

Explaining Culture Change

As we've mentioned, archaeology is the only scientific way of examining and explaining human cultural change over long periods. Thus, our third archaeological goal seeks to explain the processes of culture change in the past, topics that we explore in more detail in [Chapter 3](#). The ultimate objective is to explain why human cultures in all parts of the world reached their various stages of cultural evolution. Human tools are seen as part of a system of related phenomena that include both culture and the natural environment. Archaeologists design their research work within a framework of testable propositions that may be supported, modified, or rejected when they review all of the excavated and analyzed archaeological data.

This processual approach to archaeology (see [Chapter 3](#)) assumes that the past is inherently knowable, provided that rigorous research methods and designs are used, and that field methods are impeccable. It follows that archaeology is more than a descriptive science and that archaeologists can explain cultural change in the past.

Understanding the Archaeological Record

"The archaeological record is here with us in the present," wrote Lewis Binford (1972: 2). He emphasized how much a part of the contemporary world the artifacts and sites that make up the remains of our past are. Our observations about the past are made today, for we are describing sites and artifacts as they come from the soil today, centuries, often millennia, after they were abandoned. In this way, the archaeologist

differs from the historian, who reads a document written by a contemporary observer in, say, 1492, which conveys information that has not changed since that year. The archaeological record is made up of material things and arrangements of material objects in the soil. The only way we can understand this record is by knowing something about how the individual finds came into being. Binford likened archaeological data to a kind of untranslated language that has to be decoded if we are to make statements about human behavior in the past. “The challenge that archaeology offers, then, is to take contemporary observations of static material things and, quite literally, translate them into statements about the dynamics of past ways of life and about the conditions in the past” (Binford, 1972: 3). Archaeologists cannot study the past directly but must consider it with reference to the present. For this reason, controlled experiments, observations of contemporary hunter-gatherers and horticulturalists, and the formulation that Binford and others call “middle-range theory” are vital to archaeologists (see [Chapters 3 and 14](#)).

Wherever they work, all archaeologists, of whatever viewpoint, would agree that we cannot hope to carry out archaeological research without sound theory, good descriptive techniques, and detailed information from both the contemporary world and prehistoric lifeways. Above all, the present and the phenomena of the world we live in are there to help us achieve better understanding of major issues in the human past:

- What were our earliest ancestors like, and when did they come into being? How old is “human” behavior, and when did such phenomena as language evolve? What distinguishes our behavior from that of other animals?
- How and when did humanity people the globe? How can we account for human biological and cultural diversity?
- Under what conditions, and when and how, did human beings domesticate animals and plants, becoming sedentary farmers?
- What caused complex societies—the urban societies from which our own industrial civilization grew—to evolve?
- Last, a long-neglected question: How did the expansion of Western civilization affect the hunter-gatherer, agricultural, and

even urban states of the world that it encountered after classical times?

In the Beginning is not meant to describe these major developments in human prehistory (Fagan and Durrani, 2019; Price and Feinman, 2013). Rather, it summarizes the multitude of methods and theoretical approaches that archaeologists have used to gain a better understanding of our long past.

Summary

1. Modern archaeology is the scientific study of past cultures and technologies—whether ancient or recent—by scientific methods and theoretical concepts devised for that purpose.
2. Archaeology covers the whole human past, from the earliest times to the modern era. The discipline had its origins in treasure hunting and grave robbing, but it has evolved into a highly precise science. It has become an integral part of twentieth-century life as a component of popular culture and modern intellectual curiosity.
3. Archaeology provides the only viable means of discovering the history of many of the world's societies whose documented past began in recent times. As such, it is a vital support for nationalist feeling and for fostering cultural identity.
4. Archaeologists have major contributions to make to the resolution of modern land disputes and to modern management of resources.
5. The destruction of sites, fostered by looters within war zones, greedy collectors and industrial development, is the crisis that archaeology is faced with today. Archaeological sites are a finite resource that can never be replaced. If the present rate of destruction continues, there is a real danger that few undisturbed archaeological sites will remain by the end of this century.
6. Archaeologists also face a challenge from people who promote “pseudoarchaeologies” purporting to explain the past, such as extravagant theories that ancient Egyptians or Phoenicians

landed in the New World thousands of years before Columbus.

7. Archaeology is part of the science of anthropology, which is the study of humanity in the widest possible sense. Archaeologists use a battery of special methods and techniques to examine human societies of the past.
8. There are many types of archaeologists. Among them, prehistoric archaeologists study prehistory, that is, human history before written records; historical archaeologists use archaeology to supplement documentary history; and classical archaeologists study ancient Greece and Rome.
9. Modern archaeology has five basic goals: stewardship (conserving and managing archaeological sites), studying culture history, reconstructing past lifeways, explaining cultural process, and understanding the archaeological record as it relates to the contemporary world.

Further Reading

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Gulielmus
Collegii Medicorum et
Baronet p. 1721.



Stukeley M.D.
Societatis Regiae Londini Secius
A. Smith Sc. et. 1751.







SUGGESTED ILLUSTRATION

FOR "DR. DARWIN'S MOVEMENTS AND HABITS OF CLIMBING PLANTS."

(See Murray's *List of Forthcoming Works*.)

* * We had no notion the Doctor would have been so ready to avow his connection with his quadrumanous ancestors—the tree-climbing Anthropoids—as the title of his work seems to imply.





2

The Beginnings of Scientific Archaeology

Sixth Century B.C. to the 1950s

CHAPTER OUTLINE

Beginnings

Scriptures and Fossils

The Antiquity of Humankind

The Three-Age System

Human Progress

Historical Particularism

Culture History

Old World Archaeology

American Archaeology

Cultural Ecology

Winged Assyrian deity from the Palace of King Assurbanipal, Nineveh, Iraq, excavated by Austen Henry Layard, 1851.

Source: Courtesy of Peter Horree/Alamy Stock Photo.

Archaeologists have come a long way from the pith-helmeted professors and adventurers of cartoon and movie fame, though such characters do have their place in the history of archaeology. The great nineteenth-century archaeologists destroyed ancient cities with their reckless digging in search of the spectacular. Englishman Austen Henry Layard (1849) dug tunnels through Assyrian Nineveh. Heinrich Schliemann (1875) employed engineers who had worked on the Suez Canal to advise him on earth moving at Troy. Until the 1920s, archaeological training was highly informal, at best a short apprenticeship working alongside experienced diggers. Excavators like Leonard Woolley (1929) at Ur in Iraq or Alfred Kidder (1924) at Pecos, New Mexico, moved more earth in a week than their modern counterparts would do in over a month.

As are all scholarly disciplines, today's archaeology is a product of its

own history and of the intellectual climate in which it emerged (Trigger, 2006). This chapter examines the early development of archaeology from its beginnings in the philosophical speculations of the Greeks to the advent of radiocarbon dating and theories of cultural ecology in the 1950s. We see how archaeology began as little more than treasure hunting and how successive innovations led archaeologists in new directions, away from simple description toward multilineal cultural evolutionary frameworks for ancient times.

Beginnings

Undoubtedly, people have always speculated about human origins and the remote past for thousands of years. As early as the eighth century B.C., the Greek philosopher Hesiod wrote about a glorious, heroic past of kings and warriors. He described five great ages of history; the earliest one of Gold was a time when people “dwelt in ease.” The last was an Age of War, when everyone worked hard and suffered great sorrow (Fagan and Durrani, 2017). Speculations of this type were widespread in classical and early Chinese writings. New Kingdom officials in ancient Egypt restored and conserved Old Kingdom monuments from 1,000 years earlier. But perhaps the world’s first “archaeologist” was the sixth century B.C. King Nabonidus of Babylon; such was his passion for digging into the temples of his predecessors in search of antiquities that he then displayed them in his palace.

During the Renaissance, people of wealth and leisure began to travel in Greece and Italy, studying antiquities and collecting examples of classical art. These antiquarians, although interested in the past, conducted their activities in a haphazard, unscientific manner. Their real concern was the objects they recovered to add to their collections, not the context in which the artifacts were found or what the finds might tell them about the past. Thereafter, the first crude archaeological excavations were made into the depths of the Roman city of Herculaneum in 1783, one of several Roman settlements buried by mud and ash from the eruption of Vesuvius in A.D. 79. At Pompeii, another Roman town destroyed in the eruption, the choking ash preserved the bodies of people fleeing the eruption in panic (see [Figure 2.1](#)). These early excavations—really little more than treasure hunts—recovered a

wealth of classical Roman statuary and also revealed incredible details of life in ancient Rome.

Figure 2.1 A victim smothered by volcanic ash at Pompeii, Italy, in A.D. 79.

Source: Courtesy of Melvyn Longhurst/Alamy Stock Photo.

Wealthy collectors toured the Mediterranean, visiting the ruins of ancient Greece and Rome and bringing back classical sculptures for their country estates. These finds—and the people that made them—were, at least in part, known through the writings of classical scholars. There were some discoveries, however, that hinted at a more remote past. In Britain and Europe the less wealthy antiquaries stayed at home and speculated about ancient European history and about the builders of burial mounds, fortifications, and occasionally more spectacular monuments such as Stonehenge in southern England. When were such structures built? Had the builders resembled the American Indians, South Sea islanders, and other living nonliterate peoples?

There was only one way to find out—excavate ancient sites. These chaotic excavations yielded a mass of stone and bronze axes, strange clay pots, gold ornaments, and skeletons buried with elaborate grave goods. This jumble was confusing. Some graves contained gold and bronze, others held only stone implements, and still others housed cremated remains in large urns ([Figure 2.4](#)). Many questions were unanswered: Which burials were earliest? Who had deposited the bodies, and how long ago? Such finds were attributed to historically documented peoples or the work of elves, trolls, or witches. No one yet had a way of putting in order the thousands of years of prehistoric times that preceded the Greeks, Romans, and ancient Egyptians of biblical fame (Fagan and Durrani, 2017; Trigger, 2006).

Scriptures and Fossils

One reason early archaeologists were confused was that they had no idea how long people had been living on the earth. There were no dating techniques, such as dendrochronology (tree-ring chronology) or carbon-14 that are used today (see [Chapter 7](#)). In Western cultures, most people believed that Genesis (see [Chapter 1](#)) provided a literal

account of the Creation. God had created the world and its inhabitants in six days. The story of Adam and Eve provided an explanation for the origin of humankind and the peopling of the world. In the seventeenth century, various clergymen used the genealogies in the Old Testament to calculate when the world had been created. However, the date reached by Archbishop James Ussher of Ireland (1581–1656) became the most pervasive, and it eventually appeared in the margin of the King James version of the Bible (Grayson, 1983). According to Ussher the world had been created on the night preceding October 23, 4004 B.C. , which allowed approximately 6,000 years for all of human history.

Doing Archaeology William Stukeley: The Man Who Believed in Druids

William Stukeley (1687–1765), antiquarian, physician, and priest, was one of the earliest archaeological fieldworkers (Figure 2.2). He tempered his researches with eccentric preoccupations with an ancient British priesthood, that of the Druids, observed by Julius Caesar. Stukeley studied botany and human anatomy at Cambridge University and then went on to become a doctor. He was an enthusiastic student, who stole dog cadavers and the corpses of the homeless to satisfy his curiosity. Soon elected a fellow of the Royal Society, he became a typical scientist of the day with wide interests. He wrote learned articles on earthquakes and flute music, the origin of card games, water turbines, and royal genealogy. However, his abiding passion was British antiquities and the ancient Britons, a subject of intense interest at the Royal Society. Each year after 1710, he traveled across England on horseback, studying architecture, visiting gardens, and examining archaeological sites, the raw material for his scientific investigations.

Figure 2.2 William Stukeley, antiquarian, eccentric, and Druid obsessed.

Source: Courtesy of Chronicle/Alamy Stock Photo.

In 1716, he saw a print of the stone circles at Stonehenge and decided to make an “Exact Model” of both of the ruins and of the site’s original appearance. Between 1720 and 1724, he visited both Stonehenge (Figure 2.3) and the great prehistoric earthworks at Avebury in the same region. With his friend Lord Pembroke, he mapped the Stonehenge

uprights and observed their close association with nearby burial mounds. The two friends compiled “nice plans and perspectives” and took the time to dine seated atop one of the arch-like trilithons, where they found space enough “for a steady head and nimble heels to dance a minuet” (Piggott, 1985: 124). They also dug into several burial mounds where they found stone chips from uprights. At Avebury he rode over the surrounding countryside and identified the celebrated avenue, which links the great monument to an outlying sanctuary. Stukeley was not only the first person to produce reasonably accurate plans of both sites but also realized that they had close relationships to the surrounding landscape. His Stonehenge survey oriented the stone circles to the cardinal directions of the compass. Being a skilled astronomer, he also checked with his compass to see if they were aligned with any heavenly bodies, especially the rising and setting of the sun. He wrote: “What would be more probable ... than that unfettered man in his first worship and reverence would direct his attention to that glorious luminary the Sun” (Piggott, 1985: 222). On the longest day of the year, June 21, he observed how the rising sun shone into the center of the circles, which had been carefully aligned by the builders to commemorate this important moment in the annual round. Every modern scholar accepts this astrological interpretation of the monument. Modern-day Druids flock to Stonehenge every summer solstice to perform elaborate rituals.

Figure 2.3 Stonehenge and its ancient stone circles fascinated early antiquarians. Stukeley and two companions dined atop one of the lintels in 1724.

Source: Courtesy of Cat Edwardes/Alamy Stock Photo.

The Druid rituals of today go back to both William Stukeley and an earlier antiquarian, John Aubrey (1626–1697), who both believed that Druids constructed Stonehenge. Stukeley called Druids ancient philosophers who were the founders of ancestor worship. Carried away by his Druidical enthusiasm, Stukeley shaped his landscape maps of both Stonehenge and Avebury to accommodate his fantasies. He gave serpent’s tales to stone alignments at Avebury, and even changed the shape of a nearby stone circle to resemble a snake head. As he grew older, Stukeley became more and more obsessed with the Druids. Living

at a time when Romanticism flourished, Romantic views of earlier societies were in fashion. He even built a Druid-like temple in his garden and considered himself an “arch-Druid” named Chyndonax. In later life, he took Holy Orders, giving lengthy sermons on obscure topics of astronomy and natural history. His life became a collage of oddities and infatuations, so much so that a contemporary remarked that he was “a mixture of simplicity, drollery, absurdity, superstitions, and antiquarianism ... a compound never meant to go together” (Piggott, 1985: 117).

Figure 2.4 A nineteenth-century British burial mound excavation as depicted in *Gentleman's Magazine*, 1840. “Eight barrows were examined ... Most of them contained skeletons, more or less entire, with the remains of weapons in iron, bosses of shields, urns, beads, brooches, armlets, bones, amulets, and occasionally more vessels.”

William Stukeley may have been eccentric, but his observations are of immense value today. He traversed the countryside around Avebury and Stonehenge long before modern industrial agriculture changed the countryside profoundly. He watched local villagers quarrying the stone for buildings. The stone alignments and other features were much more complete than they are nearly three centuries later, making his records of the vanished stones of priceless value to modern investigators. He was one of the founders of a tradition of landscape archaeology and the study of changing ancient settlement patterns on the land that is fundamental to archaeology today.

Yet new geological, anthropological, and archaeological discoveries began to cast doubt on biblical chronologies. The geological record presented evidence of gradual change over long periods of time through natural processes. The bones of extinct species of animals, such as the ancestors of the elephant and the hippopotamus, came from the gravels of European rivers, some in the same strata as carefully chipped stone axes that were obviously of human manufacture (see [Figure 2.6](#)). But until the 1860s, the shackles of theological dogma confined human existence within a few millennia, and the idea of a prehistoric past stretching back thousands of years went unrecognized.

While antiquarians were digging into European burial mounds, Captain James Cook and other Western navigators were exploring the

Americas and the Pacific, bringing back new information about all manner of societies very different from contemporary European society. Some, such as Native Americans, still used stone tools similar to those found in European archaeological sites. Scholars began to put prehistory in a new perspective in terms of human progress over time, from the simple to the more complex. But could all of this progress have occurred within a mere 6,000 years?

The Antiquity of Humankind

The eighteenth century saw an awakening of interest in archaeology, geology, and the natural sciences. A knowledge explosion in science coincided with the Industrial Revolution. Geologists were in the forefront, their field studies stimulated by deep cuts into the earth resulting from vast engineering projects such as railroad and canal building. William “Strata” Smith (1769–1839) was one of many field observers who studied these exposures. He observed that the fossils of different types of animals occurred in the same relative position in different geological outcrops and, in fact, the strata could be placed in the correct order on the basis of the fossils they contained. Notably, he made this observation a half-century before Charles Darwin proposed his theory of evolution, which explained why animal species changed through time.

Based on their examinations of the geological record, many geologists felt that the rocks of the earth had been formed by continuous, natural geological processes. Every gale that battered the coast, every flash flood or sandstorm, and every earthquake were among the natural phenomena that had gradually shaped the earth into its modern form. James Hutton’s *Theory of the Earth* (1784) was among the first works to convincingly argue that the earth was formed entirely by natural processes, not by divine floods of global proportion that earlier scientists had considered the nemesis of long-extinct animals. His work was later refined by Charles Lyell, whose book *Principles of Geology* (1833) was very influential.

Hutton’s and Lyell’s theories of what became known as uniformitarianism caused a furor, for their arguments that the earth had been formed by long-term natural processes and not by divine

intervention contradicted a literal reading of biblical chronology. If one accepted these new theories, one also accepted the notion that humankind had lived on the earth for many thousands of years before written history. The debate over the antiquity of humankind culminated in 1859 with two major scientific developments: the publication of Charles Darwin's theory of evolution and natural selection, and the verification of the contemporaneity of humans and extinct animals.

Charles Darwin began to formulate his theories as a result of a five-year scientific voyage around the world aboard the *HMS Beagle* in 1831–1836, on which he witnessed firsthand the remarkable biological diversity of the world. Back in England, Darwin delved more deeply into what he called the “species question.” He was influenced by the work of Thomas Malthus, a nineteenth-century clergyman and economist who observed that a basic principle of nature was that most living creatures produced far more offspring than could be expected to survive and reproduce. Darwin realized that the characteristics of some individuals within a population would give them increased reproductive success, which, in turn, would lead to change in the characteristics of the population as a whole. This selective force is the basis of natural selection and a principal mechanism through which new species emerge.

Darwin realized that his theory would imply that accumulated favorable variations in living organisms over long periods must result in the emergence of new species and the extinction of old ones. Darwin was a meticulous researcher and a retiring man, and he delayed publishing his results. Evolution, even more than uniformitarianism, flew in the face of the sacrosanct interpretation of the account of the Creation in Genesis. He sat on his ideas for 20 years until another naturalist (a term used at the time for biologists), Alfred Wallace, sent him an essay that reached the same conclusions. Reluctantly, Darwin penned a “preliminary sketch,” as he called it, in 1859: *On the Origin of Species*.

This scientific classic described evolution and natural selection, providing a theoretical explanation for the diversity of both living and fossil species. Evolution by natural selection does not entirely explain biological phenomena, but it does provide a mechanism for biological change through time. Darwin's theories horrified many people by

assuming that human beings were descended from apelike ancestors (Figure 2.5). But the basis for his conclusions and the evidence for evolution steadily accumulated, and Darwin's theories were soon widely accepted by the scientific community. They formed a theoretical background for some important contemporary archaeological discoveries that documented the contemporaneity of ancient humans and long-extinct animals (Van Riper, 1993).

Figure 2.5 A *Punch* cartoon showing Charles Darwin with the body of a monkey perched on a tree.

Source: Courtesy of World History Archive/Alamy Stock Photo.

Discoveries of human artifacts in association with extinct animals were nothing new by 1859, for many such finds had been reported over the years, mostly at the hands of enthusiastic amateur diggers. One of the most persistent was French customs officer Jacques Boucher de Perthes, who collected stone tools and animal bones from sealed gravels of the Somme River near Abbeville, in northern France, between 1837 and the 1860s. De Perthes was ridiculed by the scientific establishment when he claimed that the makers of the axes had lived before the biblical flood. Rumors of his finds reached the ears of British antiquarian John Evans and geologist Joseph Prestwich. They visited de Perthes and examined his collections and sites. The two scientists were convinced that de Perthes had the proof they were looking for. Acceptance of the great antiquity of humankind followed an established antiquity that is one of the intellectual and practical foundations of all scientific archaeology (Grayson, 1983). (See the Discovery box, page 33.) If the Somme hand axes and other such finds were of great antiquity, then who were the people that manufactured and used them? Were they modern-looking humans or ape-like beings that were closer to apes than people? A piece of what became an increasingly complex picture of human origins came to light in a cave near Düsseldorf in Germany's Neanderthal ("Neander Valley") region in 1856, when quarry workers unearthed a primitive-looking human skull. It had a huge beetling brow ridge and a squat skullcap that were quite unlike the smooth, rounded cranium of modern *Homo sapiens*. Many scientists dismissed the Neanderthal skull as that of a modern

pathological idiot. But a minority, among them the celebrated English biologist Thomas Huxley (1863), believed that the skull was from a primitive human being, perhaps one of those who had made early stone tools. Scientists were finally realizing that humanity had evolved both biologically and culturally over a very long period.

The Three-Age System

The spectacular social and economic changes during the nineteenth century generated much interest in human progress. As early as the late sixteenth century, some antiquarians were writing about prehistoric ages of stone, bronze, and iron (Daniel, 1962). Two centuries later, these general concepts were refined by Danish archaeologist Christian Jürgensen Thomsen (1788–1865), curator of the National Museum in Copenhagen, into the famous **Three-Age System** in the early nineteenth century. He ordered the confusing collection of artifacts from bogs, burial chambers, and shell middens by classifying them into three groups, representing ages of stone, bronze, and iron, and using finds in previously undisturbed graves as a basis for his classification.

Thomsen's classification was taken up by another Dane, J. J. A. Worsaae, who proved the system's basic stratigraphic integrity. By studying archaeological finds from all over Europe, Worsaae demonstrated the widespread validity of the Three-Age System (Worsaae, 1843). A technological subdividing of the prehistoric past, this system gave archaeologists a broad context within which their own finds could be placed, a framework for dividing a prehistoric past. The Three-Age System for Old World prehistory, in modified form, survives today (see [Figure 7.4](#) on page 106).

The Three-Age System of the Scandinavians was not adopted in North America, where almost no ancient metals and no very early sites were found. Subtle changes in stone tool technology were more difficult to discern and, consequently, the past was more difficult to divide into periods. The foundations of accurate stratigraphic and chronological studies in American archaeology were laid by Thomas Jefferson and Harvard archaeologist Frederic W. Putnam in Ohio, and in the classic archaeological laboratory of the Southwest (Willey and Sabloff, 1993).

Human Progress

By the time Charles Darwin wrote *On the Origin of Species*, the Three-Age System had been well established throughout Europe. It was but a short step from the three ages to doctrines of human progress. In 1850, the sociologist Herbert Spencer (1820–1903) was already declaring, “progress is not an accident, but a necessity. It is a fact of nature” (Spencer, 1855). Darwin’s theories of evolution seemed to many people a logical extension of the doctrines of social progress. The new theories opened up enormous tracts of prehistoric time for Victorian archaeologists to fill. The oldest finds were de Perthes’s crude axes from the Somme Valley. Later in prehistory, apparently, other people started to live in the great caves of southwestern France, at a time when reindeers, not hippopotamuses, were living in western Europe. And the famous “lake dwellings,” abandoned prehistoric villages found below the water’s edge in the Swiss lakes during the dry years of 1853 and 1854, were obviously even more recent than the cave sites of France (Bahn, 1996).

DISCOVERY THE SOMME HAND AXES, FRANCE, 1859

British antiquarian Sir John Evans (1823–1908) was a remarkable individual by any standard. A successful papermaker, he was the epitome of the Victorian businessman and believed in “Peace, Prosperity, and Papermaking” (Evans, 1943). He was also a highly respected member of the scientific establishment with an impressive expertise in geology, coins, and prehistoric artifacts of all kinds. Evans and his geologist friend Joseph Prestwich were prominent members of a Royal Society committee that had supervised excavations at Brixham cave in southwestern England in 1858, where the bones of Ice Age animals lay alongside ancient stone tools. The society heard reports of de Perthes’s finds and organized a party to visit him; however, Evans and Prestwich were the only committee members who went.

After a rough sea crossing, they arrived in Abbeville in the Somme Valley and inspected the voluble de Perthes’s extensive collection of stone tools and fossil animal bones. After a sumptuous lunch, de Perthes took his visitors on a tour of the nearby gravel quarries. Evans and Prestwich collected axes and bones, but it was not until Evans

actually removed an ancient hand ax from the same sealed level as a hippopotamus bone that they realized that de Perthes was correct (Figure 2.6). They returned to London convinced that the Somme gravels held proof of a great antiquity for humankind, something that the new theories of uniformitarianism and evolution made intellectually possible.

With characteristic Victorian industry, Evans and Prestwich prepared an immediate report for the Royal Society, in which they proclaimed their support for the antiquity of humankind. All research into early human prehistory has stemmed from Evans and Prestwich's day in France a century and a half ago.

Figure 2.6 A stone axe, like those found by Evans and Prestwich in the Somme Valley found by British antiquarian John Frere at Hoxne, England, in 1797, an earlier discovery.

Source: Courtesy of Science Source.

What was the best theoretical framework for all of these finds? Could notions of human progress be made to agree with the archaeological record? Did prehistoric peoples' technology, material culture, and society develop and progress uniformly from the crude tools of the Somme Valley to the sophisticated iron technology of the much more recent La Tène culture in Europe? Had cultures evolved naturally along with the biological evolution that lifted humanity through all the stages from savagery to civilization?

Unilinear Cultural Evolution

Early anthropological theory was influenced by several diverse intellectual ideas, including biological evolution, nineteenth-century notions of social progress, and the idea of cultural evolution. A most important influence in the development of anthropology was contact between Western civilization and other human societies with completely different social institutions. Early anthropologists, corresponding as they did with missionaries and pioneer settlers all over the world, argued that Victorian civilization was the pinnacle of human achievement. This **unilinear cultural evolution** perspective, articulated by pioneering anthropologists Sir Edward B. Tylor (1832–

1917) and Lewis Henry Morgan (1818–1881), fitted anthropological and archaeological data into set stages through which all human societies progressed. According to this view, all human societies had the potential to evolve from a simple hunter-gatherer way of life to a state of literate (European) civilization, which nineteenth-century researchers saw as the end point of this evolutionary progression.

Tylor surveyed human development in all of its forms, from the crude stone axes of the Somme Valley in France to Maya temples and Victorian civilization. The origins of civilized institutions, he argued, might be found in the simpler institutions of “runder peoples.” Tylor (1878) used accounts of contemporary non-Western peoples and archaeological findings to reemphasize a three-level sequence of human development popular with eighteenth- and early nineteenth-century scholars, including Herbert Spencer: from simple hunting (“savagery”), through a stage of simple farming (“barbarism”), to “civilization,” the most complex of human conditions.

American anthropologist Lewis Henry Morgan went even farther than Tylor. He outlined no fewer than seven periods of human progress in his famous book *Ancient Society* (1877). Like Tylor, Morgan began with simple savagery and had human society reaching its highest achievements in a “state of civilization.” His seven stages, he said, had developed quite rationally and independently in different parts of the world. Morgan’s work, with its strong evolutionary bias, was to influence modern North American archaeology. Even expert scientists turned to the comfortable framework of biological and social evolution to explain the astonishing diversity of humankind.

As archaeological research extended beyond Europe and into the Americas, the incredible diversity in early human experience became visible in the archaeological record. The great civilizations of southwestern Asia were uncovered by Henry Layard and others, and the great Mesoamerican religious complexes were described (see [Figure 1.8](#) on page 16). Stone Age art was accepted as authentic some years after the Altamira paintings were discovered in northern Spain in 1875 (see the following Discovery box). Yet many parts of North America and some areas of Africa showed no signs of the early, complex civilizations found in other world areas. Furthermore, the American civilizations and European cave art seemed to imply to nineteenth-

century scientists that humanity sometimes “regressed.” Scientists became less and less certain that people had a common, consistently progressing universal prehistory.

As more and more information accumulated from all over the world, it became clear that a universal scheme of unilinear cultural evolution was a totally unrealistic and ethnocentric way of interpreting world history.

DISCOVERY THE ALTAMIRA CAVE PAINTINGS, SPAIN, 1875

Spanish landowner Marcelino de Sautuola had a casual interest in archaeology. He had visited an exhibit in Paris of some of the fine ancient stone tools from French caves. In 1875, he decided to dig for some artifacts of his own in the caverns of Altamira on his estate in northern Spain. Sautuola’s five-year-old daughter, Maria, begged for the chance to dig with him, so he good-naturedly agreed. Maria soon tired of the muddy work and wandered off with a flickering lantern into a low side chamber. Suddenly, Sautuola heard cries of “Toros! Toros!” (“Bulls! Bulls!”). Maria pointed excitedly at brightly colored figures of bison and a charging boar on the low ceiling. Daughter and father marveled at the fresh paintings, arranged so cleverly around bulges in the rock that they seemed to move in the flickering light (Figure 2.7).

Sautuola was convinced that the paintings had been executed by the same people who had dropped stone tools in the cave. But the experts laughed at him and accused the marquis of smuggling an artist into Altamira to forge the bison. It was not until 1904 that the now-deceased Sautuola was vindicated, when some paintings with strong stylistic links to Altamira came to light in a French cave that had been sealed since the ancient artists worked there.

Altamira was the first evidence that late Ice Age humans had been artists. The debate over the meaning of the paintings continues to this day.

Figure 2.7 Bison in a polychrome cave painting in Altamira, Spain. The Altamira style is the ultimate artistic achievement of the late Ice Age peoples of western Europe, circa 12,000 years ago.

Diffusion and Diffusionists

As archaeological knowledge blossomed late in the nineteenth century—and in North America, particularly in the early twentieth century—scholars faced many hard questions. What were the origins of human society? When and where was metallurgy introduced? Who were the first farmers? If people did not develop according to universal evolutionary rules, how, then, did culture change and cultural diversity come about? Archaeologists began to expect that population movements, migrations, and invasions would explain prehistory. **Diffusion** is the process by which new ideas or cultural traits spread from one person to another or from one group to another, often over long distances.

The diffusion of ideas and objects from one people to another was recognized early as a valid explanation for cultural change in prehistory, and it remains an important concept (see discussion in [Chapter 3](#)). It was especially popular with late nineteenth-century archaeologists, who reacted against the unilinear models of culture change. They also realized that culture change could be explained by outside influences. Many archaeologists accepted diffusion as the reason why southwestern Asian civilizations had been so much richer than the apparently poor European cultures of the same period. Furthermore, they argued, how could the brilliant American civilizations in Mexico and Peru have arisen, if not by long-distance migration from the civilized centers in southwestern Asia?

Unfortunately, some of these theories took the role of diffusion as an explanation of change too far. Early in the twentieth century, British anatomist Grafton Elliot Smith became obsessed with the techniques of Egyptian mummification, sun worship, and monumental stone architecture. The achievements of ancient Egyptian civilization were so unique, he argued in *The Ancient Egyptians* (1911), that all of world civilization and much of modern Western culture had to have diffused from the Nile Valley. It had been the “People of the Sun” who had produced and disseminated civilization, people who were not afraid of voyaging widely in search of gold, shells, and precious stones. Thus, he argued, sun worship and early civilization spread over the world.

Smith's hyper-diffusionist views of human history grossly oversimplified the past and they were at least as inadequate as unilinear cultural evolution. Nevertheless, hyper-diffusionist theories have remained popular. In their most extreme manifestations, they reach incredible heights of absurdity, as in seeking to prove that Africans colonized America before Columbus or that the Vikings settled in Minnesota thousands of years ago (see [Chapter 1](#)).

Historical Particularism

The first professional archaeologists and other anthropologists lived at a time when many non-Western cultures were being erased by the advance of Western, industrialized society. Consequently, they felt an overwhelming priority to collect basic information about these vanishing cultures. These data were an essential preliminary to the theoretical approaches used in archaeology today. American anthropologist Franz Boas (1858–1942) and his students helped establish anthropology—and, by implication, archaeology along with it—as a form of science by applying more precise methods to collecting and classifying data. They collected an incredible amount of data on Native American kinship systems, religion, housing, pottery designs, basketry, and thousands of other cultural details. These were then meticulously studied and used to plot culture areas. This theoretical approach to cultural anthropology is referred to as **historical particularism** (Lyman et al., 1996).

This careful cataloging of cultural data was important, yet historical particularists reached some incorrect conclusions about Native American culture, which were eventually disproved by archaeological research. For instance, ethnologists of this period saw the arrival of the Europeans and their domestic horses as an event of unparalleled importance that caused the Great Plains to become filled with nomadic, horseback-mounted buffalo hunters of the type made familiar to us by Hollywood films. The Plains were thought to have been sparsely populated up to that time. The ethnologists were partly right, for the Plains population did indeed swell rapidly as horses came into use. But subsequent work by such archaeologists as Douglas Strong, who dug at Signal Butte, Nebraska, revealed that the Great Plains had been

inhabited by hunter-gatherers and horticulturalists for many hundreds of years before the Europeans and horses turned the Plains into a carnival of nomads on horseback (Strong, 1935). Archaeology, then, became a source of information against which one checked the historical reconstructions produced by ethnologists.

Culture History

Historical particularism influenced how researchers interpreted archaeological data. **Culture history**—the description, chronological, and spatial ordering of archaeological data—became the sole objective of archaeological research and it remained so until the 1950s. Researchers dug archaeological sites and established chronological sequences and distributions. Interpretation consisted primarily of description of the diet, technology, migrations, and lifeways of past societies; the discovery of such features remains an important aspect of archaeological research.

The synthesis of site chronologies beyond the confines of one site or local area involves not only repeating the same descriptive processes at other sites but also constantly refining the cultural sequence from the original excavations. This synthesis is cumulative, for some new excavations may yield cultural materials that are not represented in the early digs. It is here that the techniques of seriation and cross-dating come into play (see [Chapter 7](#)).

The archaeological units used to aid the synthesis form an arbitrary, hierarchical classification. They represent the contents of individual sites and their distribution in time and space. The archaeological units used most widely in the Americas are those developed by Gordon Willey and Philip Phillips (1958); we describe some of them here. Throughout the world, however, the temporal framework of a culture historical approach to the past has been important in providing a means of ordering archaeological data, which can, in turn, serve as a basis for interpretation using a variety of theoretical perspectives.

Components and Phases

Components are the lowest unit in the hierarchy. They consist of a

distinct artifact assemblage that distinguishes the culture of the inhabitants of a particular time and place. A site such as the colonial village at Martin's Hundred, Virginia, consists of a single component representing a brief seventeenth-century occupation by Anglo-American settlers. Other sites may contain a number of distinct components, each representing a separate cultural phase. The Koster site in Illinois is an excellent example of a multicomponent site, with its various layers representing different components separated by sterile layers of soil extending from 7500 B.C. to less than 1,000 years ago, including evidence of the first Paleo-Indian inhabitants of the region, seasonal hunter-gatherers, and finally, a settled, year-round village (Struever and Holton, 1979).

The definition of a component depends on stratigraphic observation, as well as the archaeologist's observational skills. Some cave sites in southwestern France contain many occupation levels, separated by sterile layers, which can be neatly isolated stratigraphically and grouped on the basis of shared artifact types, such as antler harpoons or side scrapers that are distinctive for a certain time period and region.

Components occur at one location. To produce a regional chronology, archaeologists must synthesize them with components from other sites using the next analytical step, phases.

Phases are cultural units represented by different levels of the same site or like components on different sites, all sharing a distinctive artifact assemblage within a well-defined chronological bracket (Wiley and Phillips, 1958). The characteristic assemblage of artifacts of a phase may be found over hundreds of miles within the area covered by a local sequence. Many archaeologists use the term *culture* in the same sense as phase, though it should be emphasized that archaeological cultures cannot necessarily be equated with ethnographically delineated cultures. Phases or cultures usually are named after a key site where characteristic artifacts are found. The Magdalenian culture of 16,000 years ago, for example, is named after the rock shelter of La Madeleine in southwestern France, where antler harpoons and other artifacts so characteristic of this culture were found.

Some phases are but a few years long; others span centuries, even millennia. The Gatecliff rock shelter in Nevada was occupied for about 8,000 years; it is divided into five components, each defined by

distinctive artifact types associated with particular time periods (Thomas, 1983a). The components can be compared with those from other sites and used to build up a regional chronology. The components from Gatecliff and those from other sites are combined into a phase named Yellow Blade. This period dates from about A.D. 1300 to 1850, the time of European contact. The phase applies not only to Gatecliff but also to the entire region, and is the basic unit of area synthesis. At first, a phase may embrace, as the Yellow Blade phase does, 500 years or more. But as research proceeds, chronologies become more refined, and as artifact classifications become finer, the original phase may be broken down even further into more and more chronologically precise subphases.

Culture Areas

Culture areas can be thought of as the archaeological equivalent of the broad ethnographic culture areas identified by early anthropologists. In the early twentieth century, anthropologist Franz Boas compiled catalogs of the social organization, customs, beliefs, and material culture of Native American groups that were, in turn, used to define culture areas on the basis of their shared similarities. Many areas tend to coincide with the various physiographic divisions of the world. The southwestern United States is one such area, as it is defined in part by its unique history of archaeological research and in part by cultural and environmental characteristics that lasted more than 2,000 years.

Such large areas can be broken down into **subareas**, where differences within the culture of an area are sufficiently distinctive to separate one subarea from another. Gordon Willey (1966) divided the American Southwest into the Anasazi, Hohokam, and Mogollon subareas, among others (see [Figure 3.1](#) on page 45). But the term *area* implies nothing more than a very general and widespread cultural homogeneity. Within any large area, societies will adapt to new circumstances, changing in different ways and developing different economies.

Traditions and Horizons

American archaeologists use two units that synthesize archaeological

data over wide areas: horizons and traditions. The term **tradition** is used to describe artifact types, assemblages of tools, architectural styles, economic practices, or art styles that distinguish an area for a long period of time. A tradition extends longer than the occupation of individual sites or phases, and may continue for thousands of years. A good example of a tradition is the Arctic Small Tool tradition of Alaska, which originated at least as early as 4000 B.C. (McGhee, 2001). The characteristic tools made by these early hunter-gatherers were so effective that they continued in use until recent times, and aspects of this tradition can be seen in the modern Eskimo technologies of the Far North.

Horizons are represented by distinctive artifacts and cultural traits that crosscut traditions in neighboring areas. For example, a religious cult may transcend cultural boundaries and spread over an enormous area. Such cults are often associated with characteristic religious artifacts or art styles that can be identified in phases hundreds of miles apart in well-defined, contemporaneous, chronological contexts. The Chavín art style of coastal Peru, for example, was associated with distinctive religious beliefs and rituals shared by many Peruvian societies in the highlands and lowlands between 900 and 200 B.C. (Moseley, 2000). This commonality of belief is manifested in the archaeological record by Chavín art, a style that stresses exotic, jaguar-like motifs, found over a wide area of the Andes (see [Figure 2.8](#)).

[Figure 2.8](#) A Chavín wall insert of a human figure with feline features from Chavín de Huantar, Peru. Height 20 cm (7.8 inches).

Source: Rafal Cichawa/Alamy Stock Photo.

Culture history remained the dominant approach in archaeology until the 1950s (Lyman et al., 1996). Archaeologists made collecting data a primary objective in both New and Old World archaeology. But archaeology itself evolved somewhat differently on each side of the Atlantic.

Old World Archaeology

The Europeans were studying their prehistoric origins, concentrating on

constructing descriptive, historical schemes that traced European society from its hunter-gatherer origins to the threshold of recorded history. The ages of stone, bronze, and iron, of the Three-Age System, were further divided into shorter regional sequences. The earliest sites were the hand-ax sites in the Thames and Somme river valleys, followed by Ice Age cave dwellings in southwestern France that showed that the Neanderthals were succeeded by modern humans with a much more sophisticated hunter-gatherer culture. A similar culture history sequence was postulated for all of Europe and southwestern Asia as well.

Thomsen's Three-Age System provided a preliminary framework for Old World prehistory, buttressed by the work of J. J. A. Worsaae, who confirmed the stratigraphic validity of the framework. A Swedish archaeologist, Oscar Montelius (1843–1921), was deeply influenced by Darwin's evolutionary theories and traveled across Europe examining artifacts from sites of all kinds. Montelius was a genius at artifact classification, especially bronze brooches and swords. In 1885, he published *On the Dating of the Bronze Age*, a masterly study of artifacts found with undisturbed burials from Scandinavia to Greece, using minor features of different artifact forms to study their evolution through time. He assumed the simplest artifacts were the earliest, that they changed gradually through time, using as a modern example the evolution of railroad carriages from basically stagecoaches set on wheels to much more efficient designs. Montelius placed European prehistory on a new scientific footing, using artifacts of known historical age in Greece to date similar tools and ornaments found far to the west, where written records were nonexistent. All subsequent research depended, and still depends, on this remarkable archaeologist's work.

Another extraordinary archaeologist was one of those who refined European chronologies before the development of radiocarbon dating in the 1950s. Oxford-trained and Australian-born Vere Gordon Childe (1892–1957) was a gifted linguist, who acquired an encyclopedic knowledge of the thousands of prehistoric finds in museums from Edinburgh to Cairo. Once he had mastered the data, Childe set out to describe European prehistory, using "cultures, instead of statesmen, as actors and migrations instead of battles" (Childe, 1925: 7, 1958). Childe

classified cultures by their surviving culture traits—pots, implements, house forms, ornaments—known to be characteristic because they were constantly found together. He reconstructed cultural successions within limited geographic areas and compared them with those from neighboring regions, checking their culture traits—presumed to have spread from one area to another.

But Childe went farther, for he was one of the few archaeologists who realized that cataloging artifacts was useless unless conducted within some frame of reference. He therefore used data from hundreds of sites and dozens of cultures to formulate a comprehensive view of Old World prehistory that became a classic.

The origins of agriculture and domestication and of urban life were, Childe felt, two great revolutionary turning points in world history. He described (1942) two major stages, the Neolithic and the Urban revolutions. Each so-called “revolution” saw new and vital inventions that could be identified in the archaeological record by characteristic artifacts. (Remember, Childe lived through turbulent times and was heavily influenced by Marxist ideology and its notions that society moves forward through revolutions.) The idea of the Neolithic and Urban revolutions constituted a technological and evolutionary model, combined with an economic one in which the way people got their living was the criterion for comparing stages of world history. Childe’s work influenced a generation of European scholars and remains a foundation for much research today.

The later prehistoric peoples of southwestern Asia and temperate Europe were the logical ancestors of the Greeks, Romans, and other civilizations. It was no coincidence that Arnold Toynbee and other world historians adopted the archaeologists’ universal schemes when they made prehistoric times the first chapter in their great historical syntheses. Childe dominated archaeological thinking in Europe until the late 1950s. But his ideas were less influential in the Americas because Childe himself never studied or wrote about American archaeology (Trigger, 1980).

While Childe labored in Europe and the Near East, archaeologists began working more intensively in other parts of the Old World. They soon found that the Three-Age System had only limited use and that the development of human societies had proceeded differently in, say,

Africa, Australia, and China than it had in Central Europe. As this research expanded after World War II, it became clear that existing chronologies, based as they were for the most part on artifact classifications, were both inaccurate and unsatisfactory. Then, in 1949, University of Chicago scientist Willard Libby (1955) developed radiocarbon dating (described in [Chapter 7](#)), and archaeology was never the same again. For the first time, we had access to a chronological method that would date sites and major cultural developments in any part of the world, using organic materials such as wood charcoal. During the 1950s, radiocarbon dates proliferated rapidly, pushing back the dates of the first farming in the Near East and of European prehistory generally much earlier than had hitherto been assumed. The so-called “radiocarbon revolution” revealed serious problems with previous Old World chronologies, which are far more precise today, thanks to far more refined radiocarbon dates. For example, thanks to highly accurate radiocarbon dates, we now know that ancient Polynesians used their canoes to colonize eastern Polynesia within a mere 70 years.

American Archaeology

American archaeologists were in a very different position. The Three-Age System could not be used, and archaeologists initially had difficulty establishing chronologies for the archaeological record. The most logical way to do this was to work backward in time from historically known Native American sites into prehistoric times, a method that came to be known as the **direct historical approach** (see Willey and Sabloff, 1993). The early Southwestern archaeologists adopted this approach in their 1890s research tracing modern Indian pottery styles centuries into the past. This work culminated in the excavations at Pecos Pueblo carried out by Harvard archaeologist Alfred V. Kidder between 1915 and 1929 (Kidder, 1924). (See the following Site box.) These excavations established a cultural sequence still used in modified form today. Later researchers, such as Douglas D. Strong, applied similar methods to Plains archaeology with great success (Strong, 1935).

The direct historical approach has limitations. It works satisfactorily as long as one is dealing with culturally related finds. Once this

continuity is lost, however, the direct historical approach can no longer be used.

The Americas: The Midwestern Taxonomic Method

Franz Boas's influence was strong from the 1920s to the 1950s among archaeologists who concentrated on collecting and classifying enormous numbers of prehistoric finds from hundreds of sites all over the Americas. They began to arrange these finds in increasingly elaborate regional sequences of prehistoric cultures, but they ran into trouble because no two archaeologists could agree on how to handle the enormous quantities of new data emerging from large-scale dam surveys and other Depression-era "make-work" projects in the East and Midwest. Thus, no one could compare one area with another using common terminology.

Scholars in the Southwest and a group in the Midwest headed by William C. McKern wrestled with the problem, trying to find explicit and formal descriptive terms for groups of archaeological finds. McKern's group prepared definitions that soon became known as the Midwestern Taxonomic Method (Lyman et al., 2003). By correlating sequences of artifacts and hundreds of sites through long prehistoric periods using seriation methods (see [Chapter 7](#)), users of the method were able to compare cultural sequences throughout the midwestern and eastern United States. The method did provide a classificatory framework but was limited as a means of interpreting the past, simply because it relied on artifacts, many from museum collections with poor stratigraphic contexts, paying little attention to other lines of evidence about the past.

By the 1940s, James Ford, James Griffin, and Gordon Willey had begun to look farther afield than local regions. At their disposal was a mass of unpublished archaeological data from hundreds of sites excavated during the Great Depression (Willey and Sabloff, 1993). Their studies in the eastern United States revealed steady development in prehistoric material culture over many thousands of years. They distinguished periods within which broad similarities in prehistoric culture could be found and designated them as developmental stages.

S i T E > Alfred Kidder at Pecos, New Mexico, 1915–1929 <

Harvard University archaeologist Alfred Kidder first visited the Southwest in 1907 to work on a site survey. As a student, he had been to Greece and Egypt, where he visited the complex stratigraphic excavations being conducted by Englishman Flinders Petrie, among others. This experience had convinced him of the value of the humble potsherd (pot fragment), so when he started work at Pecos Pueblo in 1915, he put ceramics to good use. He worked at Pecos every year until 1929, with a three-year gap during World War I.

Pecos Pueblo, later the site of a Spanish church, had been occupied at the time of the Spanish arrival in 1540 (see [Figure 2.9](#)). Kidder took advantage of this occupation with its distinctive painted pottery to work from the known present into the remote past. Graves with their offerings of pots would give him the sealed dating units he needed to develop a pottery sequence. Kidder's workers uncovered more than 750 skeletons in the first four seasons alone. At the same time, he sifted through deep sequences of ash and occupation debris and recovered thousands of potsherds. Using the grave lots and these finds, as well as pottery from other pueblos, Kidder developed a broad outline of the Southwestern past, beginning with "Basket Makers," who were hunter-gatherers, had no pottery, and did not grow crops. Eventually, they became farmers, to be followed by pre-Pueblo and Pueblo peoples, who lived in more permanent settlements.

Ultimately, Kidder identified at least six settlements lying one on top of the other at Pecos and established a broad framework for the Southwestern past that survives, albeit in much modified form, to this day. He also established the essentially indigenous development of Southwestern culture.

[Figure 2.9 Pecos Pueblo, New Mexico. The Spanish mission church was built over the pueblo.](#)

Source: Courtesy of Jon Arnold Images Ltd/Alamy Stock Photo.

Gordon Willey and Philip Phillips extended earlier survey work in a landmark monograph (1958) that applied essentially the same techniques to archaeological materials throughout the Americas. Most important, they devised developmental stages for the entire continent. These proposed stages were defined by technology, economic data,

settlement patterns, art traditions, and social factors rather than by chronology, which, to their way of thinking, was a less important consideration.

The Americas: Chronology and Timescales

No question worried the American archaeologists of the 1920s to the 1950s more than establishing an age for their sites and finds. Once they reached the limits of direct historical ties, they had no way to date early American cultures. Typologies and classification schemes based on stratigraphy only provided the relative age of the finds, not absolute dates. The first breakthrough came in the early years of the twentieth century, when University of Arizona astronomer Andrew E. Douglass started his now-famous studies of annual growth rings in trees in the Southwest. By 1929, Douglass had developed an accurate chronology for southwestern sites that eventually extended back from modern times into the first century B.C. Unfortunately, tree-ring dating is best suited to areas such as the Southwest, where trees have a well-defined annual growth season and the dry conditions favor archaeological preservation. (The method is now used successfully in northern areas.)

Here, as in the Old World, radiocarbon dating revolutionized our perceptions of the pre-Columbian Americas. For the first time, actual numerical dates superseded the guesswork of earlier years. American archaeologists could finally compare widely separated sites and cultures with a uniform timescale. They could now de-emphasize chronology and classification and concentrate instead on other questions.

Cultural Ecology

Before and after radiocarbon dating arrived, new emphases in archaeology on the study of human settlement against the changing landscape developed, pioneered by Cyril Fox and other fieldworkers in Britain (Fox, 1932), and on interpretation, based on carefully studied regional sequences. One conclusion was obvious: Human material culture and social organization had developed from the simple to the infinitely complex. From then on, many accounts of world prehistory or broad syntheses of large culture areas allowed for the general notion of

progress in prehistory (Childe, 1942; Willey, 1966, 1971).

Multilinear Cultural Evolution

In the late 1930s, anthropologist Julian Steward asked, “Are there ways of identifying common cultural features in dozens of societies distributed over many cultural areas?” Unlike unilinear evolutionists, who insisted that all societies passed through similar stages of cultural development, Steward assumed that certain basic culture types would develop in similar ways under similar conditions. Very few actual concrete features of culture, though, would appear in a similar, regular order repeated again and again. In other words, **multilinear cultural evolution** had proceeded on many courses and at different rates, not just on one universal track. Steward added the environment as a critical variable and looked to it for causes of cultural variation and change. To do so, he developed a method for recognizing the ways in which culture change is caused by adaptation to the environment.

Calling his study of environment and culture change cultural ecology, Steward laid down three principles (1955):

1. Similar adaptations may be found in different cultures in similar environments.
2. No culture has ever achieved an adaptation to its environment that has remained unchanged over any length of time.
3. Differences and changes during periods of cultural development in any area can either add to societal complexity or result in completely new cultural patterns.

Steward used these principles as a basis for studying cultures and culture change. To study different cultures, he would isolate and define distinguishing characteristics in each culture, a nucleus of traits he called the cultural core. He observed, for example, that African San, Australian Aborigines, and Fuegian Indians in South America were all organized in patrilineal (descent through the father) bands, forming a cultural type. Why? Because their similar ecological adaptations led to comparable social organization. Although their environments differed greatly, from desert to cold and rainy plains, the practical requirements of small bands, each with its own territory, living a hunting and

gathering lifeway was fundamentally the same, despite many differences in detail. Steward employed his cultural-core device to isolate and define distinguishing characteristics of the hunter-gatherer and of other specific culture types.

Steward studied the relationships between environment and culture that form the context and, consequently, the reasons for cultural features. A culture trait, be it a new type of house or a form of social organization, might be found at one location because it had diffused there, but that did not explain why the people had accepted the trait in the first place. Steward applied cultural ecology to such questions and to problems such as why the adjustment of human societies to different environments results in certain types of behavior. To diffusion and evolution he added a new concept: changing adaptations to the natural environment. In other words, the study of culture change involved studying human cultures and their changing environmental conditions as well.

Cultural ecology studies the whole picture of the way in which human populations adapt to and transform their environments. Human cultures are thought of as open systems because their institutions may be connected with those of other cultures and with the environment. Open-system ecology assumes a great deal of variation between individual modern and archaeological cultures. Any explanation of culture has to be able to handle the patterns of variation found in living cultures, not just the artificial ones erected by classifiers of archaeological cultures. So many factors influence cultural systems that order can be imposed only by understanding the system—those processes by which cultural similarities and differences are generated. Many complex factors are external to the culture and cannot be controlled by the archaeologist.

There are obvious difficulties in studying the interactions between people and their environments, especially when preservation conditions limit the artifacts and other data available for study. Because technology is a primary way in which different cultures adapt to their environment, models of technological subsystems allow archaeologists to obtain a relatively comprehensive picture of the cultural system as a whole. Every aspect of the cultural system has to be reconstructed separately, using the evidence specifically relevant to that facet. In time,

from such reconstructions, a comprehensive picture of the whole cultural system will emerge.

Multilinear evolution recognizes that there are many evolutionary tracks, from simple to complex, the differences resulting from individual adaptive solutions (Steward, 1955). Cultural adaptations are complex processes that are fine-tuned to local conditions, with long-term, cumulative effects.

Walter Taylor's *A Study of Archaeology*

Beginning in the 1950s and 1960s, some archaeologists argued that archaeologists should not simply describe the past, but rather explain why certain patterns or developments occurred. When Steward's work appeared, American archaeology was completely preoccupied with chronology and artifact description. It was as if archaeologists were classifying insects or collecting postage stamps. Then, in 1948, archaeologist Walter W. Taylor published his famed work, *A Study of Archaeology*, a devastating critique of American archaeologists' preoccupation with description and chronology.

In this landmark book, Taylor called for shifting emphasis from chronological sequences and distributions to detailed, multilevel studies of individual sites and their features, such as cultural layers, floors, or hearths. This approach brought together all possible sources of evidence on a site—technology, artistic styles, ecological evidence, architecture, and information on social life—to focus on the people who had lived at the site and on the changes in their culture. Taylor tried to introduce into archaeology a view of culture that recognized the discipline as being integral to anthropology. He felt that the disciplines should work together to arrive at general truths about human culture.

The radiocarbon revolution reshaped the course of archaeology from the 1950s onward. As we have seen, it redirected much thinking from chronology and artifacts toward broader environmental and theoretical questions. Libby provided the chronological tools. Steward's and Taylor's research brought twentieth-century archaeology to the threshold of great theoretical change. They established, once and for all, the close relationship between archaeology and anthropology. *A Study of Archaeology* showed, with incisive clarity, that one of archaeology's

primary goals must be to develop adequate explanations for human prehistory, an aim far more sophisticated than mere excavation, collection, and description. More accurate chronologies, also Steward's view of multilinear cultural evolution and cultural ecology greatly influenced archaeologists. They provided critical foundations for the major archaeological developments of the 1960s and beyond, discussed in [Chapter 3](#).

Summary

1. Archaeology originated in the intellectual curiosity about the past felt by a number of classical writers, such as Hesiod, who speculated about human origins and stages in early human history.
2. After the Renaissance, this curiosity manifested itself in excavations at Herculaneum and Pompeii, where classical Roman statues were uncovered and used to decorate the estates of wealthy Europeans. There were also discoveries of far more primitive artifacts—stone tools that hinted at a more ancient, prehistoric past. But speculations about prehistory were shackled by a literal interpretation of the Bible.
3. With greater knowledge of human biological and cultural diversity late in the eighteenth century, people began to speculate about the relationships among different groups and about the notion of human progress from simple to complex societies. From the discoveries in the Somme Valley, France, and elsewhere, the bones of extinct animals directly associated with tools made by human beings proved that humanity had existed for far longer than the 6,000 years allowed by written history. These discoveries could not be placed in a scientific context, however, until uniformitarian geology, the new science of paleontology, and the theory of evolution by natural selection had been developed.
4. The notion of human social evolution followed that of biological evolution. Many archaeologists thought of prehistoric cultures as arranged in layers of progress from the simple to the complex. A

simple form of unilinear cultural evolution was espoused by such pioneer anthropologists as Edward B. Tylor and Lewis Morgan, who portrayed humanity as having progressed from simple savagery to complex, literate civilization.

5. Unilinear cultural evolution was far too simple a scheme to satisfactorily explain prehistory. Some scholars turned to diffusion as a means of explanation, and, in the extreme, some assumed that many aspects of civilizations had emanated from Egypt or similar so-called “cradles of civilization.” These hyper-diffusionist explanations, often based on limited archaeological data, proved just as unsatisfactory as unilinear models. Influenced by Franz Boas and Vere Gordon Childe, archaeologists began to describe artifacts and sites much more precisely and preoccupied themselves with culture history and chronologies.
6. American archaeologists used the direct historical approach to prehistory extensively, working back in time from known historical cultures to prehistoric societies. Standard taxonomic systems were also developed in the 1930s and were widely used.
7. Radiocarbon dating arrived in the late 1940s, coinciding with greater interest in the natural environment and the study of human ecology. Anthropologist Julian Steward formulated the principles of cultural ecology, studying the relationships between human cultures and their natural environments.
8. Walter W. Taylor’s *A Study of Archaeology*, published in 1948, was a landmark critique of American archaeology, chiding archaeologists for their preoccupation with description and artifact chronologies rather than the interpretation of past social systems and the explanation of culture change. This groundbreaking work, and increasingly multilinear views of cultural evolution, helped lay the foundation for modern, explanatory archaeology.

Further Reading

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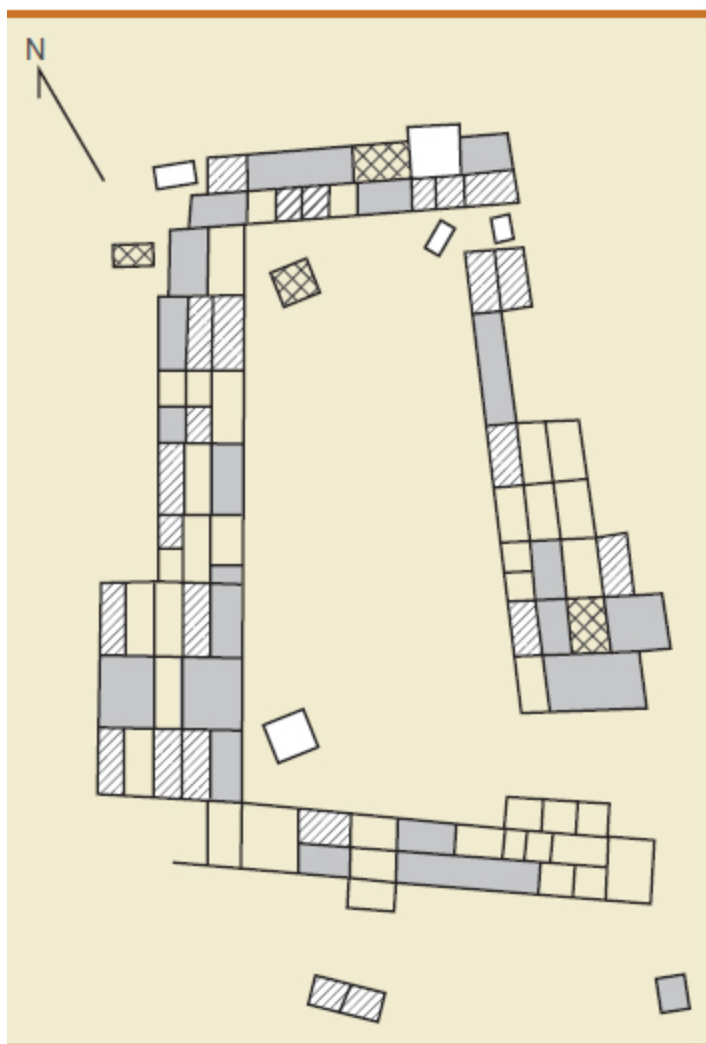














3

The Many-Voiced Past

Archaeological Thought From the 1950s to Now

CHAPTER OUTLINE

Culture History

The “New” Archaeology

Processual Archaeology

Postprocessual Archaeology

Some Schools of Archaeological Theory

What Lies Ahead?

Hominin footprints, 3.5 million years old, at Laetoli, Tanzania, East Africa.

Source: Courtesy of Science Source.

Chance preserved the earliest-known human footprints. One day, about 3.5 million years ago, two hominins walked across a dry streambed where a path across soft volcanic ash led to a nearby water hole. The ash hardened in the tropical sun and was then buried by more fine ash from another eruption. The two hominin trails, made by individuals with a rolling and slow-moving gait, with the hips swiveling at every step, came to light when the world-famous paleoanthropologist Mary Leakey excavated the streambed in the 1980s (Leakey and Harris, 1990). An accident of nature had preserved the footprints of the two upright-walking hominins, who had stood between 4 feet 7 inches (1.4 m) and 4 feet 11 inches (1.49 m) tall.

It is astounding what modern science can tell us about unique finds such as the Laetoli footprints in East Africa, far more than was possible even a generation ago. Archaeology has changed almost beyond recognition in four decades, as have the other social sciences. The computer, statistical methods, and the philosophy of science have transformed archaeology from a primarily descriptive discipline into a much more comprehensive study of the past. This chapter discusses modern archaeology, starting with its foundation in culture history, then going on to the processual archaeology of the 1960s and concluding with the new theoretical approaches that developed in the following decades.

There are many different perspectives that can only be briefly considered here. As will be seen, rather than replacing one another, new ideas are often combined with or remain alongside of the old. We should stress that there is no one theoretical approach embraced by all archaeologists. Although they share an interest in the past and, necessarily, use similar methods to uncover the material record of societies, all archaeologists bring different theoretical perspectives to their views of the past. Theory is important because it structures the research questions asked, the types of data collected, and the interpretive framework the archaeologist uses in his or her work. This chapter provides a context for the emergence of modern archaeology and gives an impression of the wide diversity of theoretical perspectives in an increasingly multivocal archaeology.

Culture History

As we saw in [Chapter 2](#), the construction of culture history has been a major preoccupation of archaeologists since the early years of the twentieth century, and it remains an important aspect of research. Culture history is based on the chronological and spatial ordering of archaeological data. Its basic methods are now well established, even if they are still debated (Lyman et al., 1996). As will be seen, there are other perspectives of the past, some of which are very critical of culture history's emphasis on description and its lack of explanation (see the discussion of processual archaeology on pages 50 and 51). Nevertheless, culture history has provided an important foundation for understanding technological developments, chronology, and the archaeological record. Much of the terminology developed—culture areas, traditions, horizons, and phases, as well as the criteria of their definition—remains in use (see [Figure 3.1](#)). Many parts of the world remain poorly known archaeologically, and basic description of the archaeological record is still an important concern. In addition, although new theoretical perspectives have emerged, some of the concepts employed by culture historians, such as analogy, invention, diffusion, and migration, remain important interpretive concepts.

[Figure 3.1](#) Archaeological regions and subareas in the North American Southwest.

Interpretation of Culture History

The primary basis for interpretation of culture history depends on descriptive cultural models and ethnographic analogy (see [Chapter 14](#)). A number of cultural and noncultural models (such as environmental change, discussed in [Chapter 12](#)) have been developed to describe culture change. The cultural models are inevitable variation, **cultural selection**, and the three classic processes—invention, diffusion, and migration (Trigger, 1968).

Inevitable variation is somewhat similar to the biological phenomenon of genetic drift, except that it concerns change in human societies rather than gene frequencies in populations. As people learn the behavior patterns of their society, inevitably some small differences

in learned behavior will appear from generation to generation. Although minor in themselves, these differences accumulate in a “snowball effect” over a long period. For instance, the variation in Acheulian hand ax technology throughout Europe and Africa between 100,000 and 150,000 years ago can be explained in part by the effects of inevitable variation.

Inevitable variation is often the result of isolation, that is, of a very low density of humans per square mile. It should not be confused with broad trends in prehistory that developed over long periods; and it is different from what happens when a society recognizes that certain culture changes or inventions may be advantageous. For example, many early Old World farming societies deliberately took up plow agriculture once they saw the advantages it gave neighboring peoples who had already adopted this new way of tending the land.

Cultural selection is the notion that human cultures accept or reject new traits—technological, economic, or intangible—on the basis of whether they are advantageous to the society as a whole. Cultural selection results in cumulative culture change, and it operates within the constraints of the prevailing values of the society. This condition tends to make it harder for a society to accept social change as opposed to technological advances, which are less circumscribed by restrictive values. The state-organized societies in Mesopotamia and Mexico resulted from centuries of gradual social evolution, where centralized political and religious authority was perceived to be advantageous.

Figure 3.2 Gold- and iron-bladed daggers of the Egyptian pharaoh Tutankhamun, 1323 B.C. The iron blade was probably made of native hammered iron. Iron metallurgy was a crucial early invention. The Egyptians tried, without success, to obtain iron tools from the Hittites in distant Anatolia after hearing of the revolutionary new metal.

Source: Courtesy of robertharding/Alamy Stock.

Invention

Invention is a new idea that either modifies an old idea or series of ideas or creates a completely new concept; it may come about by accident or by intentional research. Fire was probably the result of an accident; the atom was split by long and patient investigation with the

ultimate objective of fragmentation. Inventions spread, and if they are sufficiently important, they spread widely and rapidly. Archaeologically, inventions can be seen in the emergence of new artifact types, artistic styles, construction methods, technological developments, or other tangible innovations that can be observed in the material record.

Early archaeologists often assumed that metallurgy and other major innovations were invented in only one place (see [Figure 3.2](#)). But as the archaeological record became better documented, they realized that many inventions occurred separately in several parts of the world where identical adaptive processes were used. For example, agriculture is known to have developed independently in southwestern and East Asia, Mesoamerica, South America, and Africa.

Diffusion

Diffusion is the process by which new ideas or culture traits spread from one person to another or from one group to another, often over long distances, as discussed in [Chapter 2](#). Diffusion can result from such diverse mechanisms as trade, warfare, visits between neighboring communities, and migrations of entire communities. The key factor is the formal or informal mechanisms of contact between the members of separate groups that result in the spread and acceptance of a new idea.

Several criteria must be satisfied before researchers can decide whether a series of artifacts in archaeological sites distant from one another are evidence of diffusion. First, the traits or objects must be sufficiently similar in design and typological attributes to indicate that they probably had a common origin. Second, it must be shown that the traits did not result from convergent evolution. The development of a trait, perhaps a form of architecture or the use of a domestic animal, must be carefully traced in both cultures. Third, distributions of the surviving traits, as well as those of their antecedents, must be carefully studied. The only acceptable evidence for diffusion of a trait is a series of sites that show continuous distribution for the trait or, perhaps, a route along which it spread when plotted on a map. Accurate chronological control is essential, with a time gradient from either end of the distribution or one from the middle.

Theoretical speculations are all very well, but they may result in completely false conclusions, sometimes supported by uncritical use of scanty archaeological evidence. There are many valid instances of diffusion in ancient times. A well-documented instance is the religion of the Adena and Hopewell peoples of the American Midwest, who held beliefs associated with death that spread far beyond the relatively narrow confines of the Midwest. Religious beliefs are expressed in the form of distinctive rituals, which for the Adena and Hopewell involved extensive earthworks and mound building. Such monuments are found outside the Adena and Hopewell heartlands, as are the cult objects associated with Hopewell ritual (see [Figure 3.3](#)).

Diffusion itself is not a cause of the spread of culture traits; it is a way of referring to a set of phenomena caused by a wide range of cultural factors. To say that bronze sword-making diffused from one society to another is merely to describe what happened. It does not describe how the spread occurred. Under the culture-historical paradigm, diffusion has been invoked as a satisfactory explanation for distribution patterns of culture traits when, in fact, the factors behind the diffusion are still unexplained.

Migration

Migration is the actual movement of human populations, whether large or small. It may be peaceful, or it can be the result of deliberate aggression, invasion, and conquest (Chapman and Hamerow, 1997). In each case, however, people deliberately expand into new areas. English settlers moved to the North American continent, taking their own culture and society with them; the Spanish conquistadors conquered the indigenous societies of Mexico. Such population movements result not only in diffusion of ideas but also in the actual movement of people.

[Figure 3.3](#) About 2,000 years ago, a Hopewell artisan cut this human hand from a sheet of mica. It was found in an Ohio burial mound with the body of its owner, who lived 370 miles (595 km) from the nearest mica source. An example of the consequences of the diffusion of religious beliefs, this hand probably had powerful shamanistic associations in Hopewell society.

Source: Courtesy of Heritage Image Partnership Ltd/Alamy Stock Photo.

Perhaps the classic instance of migration in world prehistory is that of the Polynesians, who settled the remote islands of the Pacific by voyaging from archipelago to archipelago (Kirch, 2000). Each time, voyagers discovered the islands through a deliberate act of exploration, for they set out with every intention of returning (see the Discovery box on page 49). Hawaii, Rapa Nui (Easter Island), and Tahiti were first settled through deliberate colonization by a small number of people to a new, uninhabited landmass. The kind of total population movement, or in some cases, population replacement, that occurs with mass migrations of this type was rare in ancient times. It is reflected in the archaeological record either by totally new components and phases of artifacts or by skeletal evidence.

A different type of migration, on a much smaller scale, occurs when a small number of foreigners moves into another region and settles there as an organized group. A group of Oaxacans may have done just that at Teotihuacán in the Valley of Mexico more than 1,500 years ago (Millon, 1973). They settled in their own precinct of the city, identified by a concentration of Oaxacan potsherds and ornaments. The Oaxacan enclave lasted for centuries.

There are other forms of migration, too. Slaves may be transported over vast areas, as Africans were in the era of the Atlantic trade, while artisans and craftsmen may wander as unorganized migrants. There are great warrior migrations, such as those of the eastern nomads in temperate Europe and the warlike Nguni tribes of southern Africa. Each of these warrior bands swept over indigenous, sedentary populations, causing widespread disruption and population shifts. But within a few generations, the warrior newcomers had adopted the sedentary way of life of their neighbors and were virtually indistinguishable from them. Such migrations may leave few traces in archaeological sites. Promising results have been obtained by studying the strontium ratios of teeth, which have, for example, allowed scholars to identify immigrants, even perhaps a Native American, among Norse burials in medieval Iceland (see [Chapter 16](#)).

Interpretation of the culture-historical approach consists primarily of the description of archaeological record and what happened in the past. In itself, culture history takes little account of why certain developments occurred, why cultures changed, or the role of artifacts in

the cultural system as a whole. Explanation of cultural process is a central concern of modern archaeological research.

The “New” Archaeology

Major transformations in the way archaeologists go about their business began in the 1950s, soon after the publication of *A Study of Archaeology* by Walter Taylor in 1948 (see [Chapter 2](#)). Archaeologists started to reassess what the objectives of archaeological research were and how they could use the material they excavated to explain, not just describe, what happened in the past. These new attitudes coincided with the arrival of many technological innovations, such as the computer, sophisticated statistical methods, carbon-14 and other numerical dating techniques, and new methods for locating and identifying archaeological sites (Spaulding, 1953; Willey and Sabloff, 1993). Changing ideas among researchers and the application of these new methods brought about a new approach to archaeological evidence.

One of the most influential pioneers in this revised view of the past was Lewis Binford (1931–2011). In the 1960s, Binford wrote a number of papers that argued for a radically different approach to the past. Binford advocated the importance of theory and underscored the close links between archaeology and cultural anthropology. The ultimate objective of archaeology, he argued, was to search for universal laws that govern culture change. Some British archaeologists, especially David Clarke (1968), also joined Binford’s call for a reassessment of archaeological research. Binford and his disciples’ view of archaeology was so different that it was soon called, somewhat ambitiously, the “new archaeology.”

The new archaeologists were very optimistic about the potential of archaeology to contribute to anthropology as a whole. They challenged the assumption that, because the archaeological record is incomplete, reliable interpretation of the nonmaterial and perishable components of prehistoric society and culture is impossible. All artifacts found in an archaeological site, they argued, functioned in a particular culture and society. They occur in meaningful patterns that are systematically related to the economies, kinship systems, and other contexts within which they were used. Thus, artifacts are far more than mere material remnants. The archaeologist’s task is to devise methods for extracting

this information.

DISCOVERY Migration and Ancient Pacific Navigation

When British navigator Captain James Cook visited Tahiti in 1769, he puzzled over a question that has fascinated scholars ever since. How had the Tahitians colonized their remote homeland? How had humans with only simple canoes and no metals migrated across vast tracts of open ocean to settle on the remotest islands of the Pacific? Cook met an expert Tahitian navigator, Tupaia, and asked him how canoe navigators made their way from island to island out of sight of land. Tupaia explained how they used the sun as a compass by day and the moon and stars by night. When Cook marveled at the Polynesians' ability to sail against the prevailing winds for hundreds of miles, Tupaia pointed out that westerlies blew from November to January, and these were months when canoes could make good progress to windward. Tupaia carried a mental file of Polynesia in his head. Modern scholars believe that Tupaia could define an area bounded by the Marquesas in the northeast, the Tuamotus to the east, the Australs to the south, and the Cook Islands to the southwest. Even Fiji and Samoa to the west lay within his consciousness, an area as large as Australia or the United States.

Later explorers did not interview Tahitian navigators. Many scholars assumed that canoes blown accidentally far offshore colonized the Pacific Islands. But in 1965 English small-boat sailor David Lewis encountered aged canoe navigators in the Caroline Islands of Micronesia. He learned how the navigators used the zenith passages of key stars to navigate far from the land, using swell direction, waves reflected off distant land, and even the flights of sea and land birds to make landfall on island archipelagos far from their departure point. They were also capable of returning to their homes safely, using the same signs of sea and sky. Lewis, determined to preserve a rapidly vanishing art, sailed his ocean-going, European-designed catamaran from Rarotonga in the Cook Islands to New Zealand using only a star map and a Polynesian navigator to help him. In the 1970s, Lewis apprenticed himself to the pilots of the Caroline Islands, learning how they made passages with the aid of sun, moon, stars, cloud and swell formations, and passing birds.

In the late 1960s, anthropologist Ben Finney (1994) began long-term experiments with replicas of ancient Polynesian canoes. Finney's first replica was *Nalehia*, a 40-foot copy of a Hawaiian royal canoe. Tests in Hawaii's windy waters showed that it could sail across the wind, so Finney planned a voyage from Hawaii to Tahiti and back. His second replica was built from a composite of canoe designs known throughout the Pacific Islands. *Hokule'a* was 62 feet (18.89 m) long, with double hulls and two crab-claw-shaped sails designed by Hawaiian Herb Kawainui Kane (see [Figure 3.4](#)). Finney, Satawal Island navigator Mau Piailug, and a mainly Hawaiian crew sailed *Hokule'a* from Hawaii to Tahiti and back in 1976. This journey was followed by a two-year voyage around the Pacific using only indigenous pilots. Thanks to the successful *Hokule'a* experiments, ancient Polynesian navigational skills have been preserved for posterity.

Figure 3.4 The Polynesian canoe *Hokule'a*.

Source: Courtesy of National Geographic Image Collection/Alamy Stock Photo.

The new archaeology advocated rigorous scientific testing using formal scientific methods, an approach strongly influenced by the philosophy of science as presented by Carl Hempel (1966). Previously, inferences about the archaeological record had been made by simple induction, along with guidance from ethnographic data. Evaluation of the conclusions reached was based on how professionally competent and honest the archaeologists interpreting the past were perceived to be (Binford, 1962, 1972, 1980, 1983). Binford suggested that, although induction and inference were sound methods for understanding the past, the real need was for independent methods, commonly used in science, for testing hypotheses about the past, and that these methods must be far more rigorous than the value judgments arrived at by assessing professional competence.

Working hypotheses were nothing new in archaeology. What was different about Binford's approach was that he argued that these hypotheses be tested explicitly against archaeological data and against alternative explanations. Once a hypothesis has been successfully tested against raw data, it can join the body of reliable knowledge upon which further hypotheses can be based. These propositions in turn require

additional testing and, perhaps, entirely new approaches to the excavation and collection of archaeological material. The ultimate objective was to explain past sociocultural phenomena in terms of universal laws of culture dynamics: Why did the hunter-gatherers turn to agriculture and domestic animals for their livelihood, or what cultural responses occurred under certain environmental conditions?

Doing Archaeology Hypothesis Testing at Broken K Pueblo, Arizona

The processual archaeology of the 1960s revolutionized approaches to archaeological method and theory. Practitioners of this “new archaeology” were very optimistic about the ability of archaeology to contribute to anthropology as a whole. They advocated the use of explicit research designs, which included statistical methods and the rigorous scientific testing of hypotheses using formal scientific methods. One of the best examples of the applications of the methodology of new archaeology is provided by James N. Hill’s excavations at Broken K Pueblo, Arizona (1968). The Broken K site is a stone pueblo—with 95 rooms—that was occupied by Native Americans from about A.D. 1150 to 1280. Hill’s objective was to explain the patterning of cultural features at the site with regard to prehistoric residence patterns.

Preliminary trenching and clearing of surface levels were used to reveal most of the rooms at the site. As the pueblo was fairly large, the site could not be entirely excavated, so Hill excavated a random sample of 46 rooms (see [Figure 3.5](#)). In the course of excavation, Hill observed three different kinds of rooms. These were described in a clear and rigorous fashion, the variables noted and the data analyzed using the chi-square test of association and the Fisher Exact Test. The variables Hill considered were room size, masonry style, and the height of the door sill, as well as the presence or absence of fire pits, meal bins, ventilators, and doorways. He also examined the number of each type of room relative to the others. Analogies with modern Zuni and Hopi pueblos allowed Hill to interpret the Broken K rooms as habitation rooms, storage rooms, and specialized rooms for rituals (kivas).

With these analogies in mind, Hill then developed 16 hypotheses

predicting the kinds of artifacts that would be present in the various types of rooms, which he then tested in light of the archaeological data recovered. For example, the habitation rooms would be expected to contain a wider variety and larger number of materials than other rooms, while the smaller rooms and ritual areas would contain fewer artifacts with less variation, reflecting the specialized activities that took place there. These observations also allowed Hill to estimate the number of households that likely resided at the settlement.

The clear statements of hypotheses enabled Hill to verify the analogies made, as well as to raise further hypotheses about why some expectations were not validated by the archaeological data. For example, the fact that large numbers of undecorated storage pots were not recovered from the storage rooms may suggest that the storage practices of 700 years ago were slightly different from those in ethnographically observed pueblos.

Archaeologists now use many different theoretical and methodological approaches, but a clear research design and the assumptions made during interpretation remain important.

Figure 3.5 Different kinds of rooms at Broken K Pueblo. The gray areas represent “large rooms,” the hatched areas are “small rooms,” and the crosshatched areas are “special rooms.” Blank areas were not excavated. James Hill developed a number of testable hypotheses about the types of artifacts that would be recovered from all of the different rooms.

Source: Figure based on James N. Hill, “Broken K Pueblo: Patterns of Form and Function,” in Lewis and Sally Binford, Eds., *New Perspectives in Archaeology*, pages 103–142.

The new archaeology was really a synthesis of many diverse trends, among them cultural ecology, multilineal cultural evolution, and an emphasis on new scientific methods and computers. These trends were fused into what is today referred to as processual archaeology.

Processual Archaeology

Processual archaeology focuses on the cultural process and the explanation of culture change (O’Brien et al., 2007). It also brings an explicitly scientific methodology to the interpretation of archaeological

data. Processual archaeologists rely on the scientific method to formulate testable hypotheses and proceed to the gathering of new data to test them (Watson et al., 1984; for more on archaeology as a science and the scientific method, see [Chapter 5](#)). The processual approach is firmly based on culture history. It has to be, for the chronological and spatial frameworks for prehistory come from descriptive methods developed over many generations.

The difference between the descriptive and processual approaches lies in the orientation of the research. In the early days, processual archaeologists searched for universal laws of human behavior relating to the relationships between human cultures and the environment, ecological adaptation, and cultural evolution. Most of these laws were so generalized, however, that they were of little value, while the complexity of social phenomena made it exceedingly difficult to evaluate other questions using hypothesis testing. The **deductive-nomological approach**, with an explicit focus on hypothesis testing and the identification of laws of culture dynamics, initially advocated by Binford, is rarely used now. Nonetheless, problem-oriented research, explicitly stated research questions, and a clear research design remain integral in archaeological research (see the Doing Archaeology box).

Another important aspect of processual archaeology is the **systems-ecological approach**, which involves thinking of human cultures as complicated agglomerates of components, such as technology, subsistence strategies, and social organization, that interacted with each other and, in turn, with the larger environmental systems of which they were part. Human culture was, ultimately, seen as an adaptation to the environment (Flannery, 1968). It involves three basic models of culture change: systems models, which are based on **general systems theory** (see [Chapter 6](#)); **cultural ecology**, which provides models of the interactions between human cultures and their environments (see [Chapter 2](#)); and **multilinear cultural evolution**, which brings systems theory and cultural ecology together into a closely knit, highly flexible way of studying and explaining cultural process (see [Chapter 2](#)).

The advantage of systems theory is that it frees researchers from overemphasizing one agent of culture change, such as diffusion or migration, allowing them to focus instead on regulatory mechanisms and on the relationships between various components of a cultural

system and the system as a whole and its environment. The systems approach is as valuable to archaeology as a general concept is to the study of ecology.

Initially, practitioners of the new archaeology believed that processual archaeology would allow researchers to investigate all aspects of human experience, including such intangibles as ideological beliefs (Binford and Binford, 1968). But very soon the focus tended toward ecology and subsistence, to the point that some processualists referred to investigations of the intangible as an inaccessible “paleopsychology” (Binford, 1987). Processual archaeologists have made important studies of the ecological, technological, and economic constraints that act on human societies.

Postprocessual Archaeology

Inevitably, there was a reaction against the materialist approach of many processual archaeologists, which seemed to dehumanize the past in a quest for processes of culture change. Many noneconomic and nonecological factors also influence human behavior, as do the physical limitations of the human body and the nature of the human brain. So, instead of saying that the environment was responsible for culture change, one can argue that it constrained human behavior. During the late 1970s and 1980s, more researchers began thinking about the entire spectrum of human behavior—the development and expression of human consciousness, religion and worldview, symbolism and iconography—as part of a more holistic archaeology.

Thus was born **postprocessual archaeology**, a sometimes extreme antidote to its predecessor—in general terms, a reaction against the relatively anonymous, processual approach, which emphasized cultural processes and adaptation to the environment over groups of people and individuals (Bintliff, 2004; Trigger, 2006; Yoffee and Sherratt, 1993). Defined by the perspective that preceded it, the term *postprocessual archaeology* actually embraces a variety of different theoretical perspectives, vantage points, and views of the potential methodologies of scientific inquiry.

Some of the passions raised by postprocessual archaeology are a reflection both of Western society in transition and an interdisciplinary

field made up of dozens of specialties. It incorporates several often compellingly expressed intellectual developments that parallel “postmodernist” schools of thought in science, literature, and anthropology (Shanks and Tilley, 1987a, 1987b). A particularly important aspect of some postprocessual perspectives is delineating archaeologists’ roles in modern society and the need for the archaeologist to reflect on how this affects his or her views of the past. Agency or individualism and feminist perspectives, as well as the role of minorities, children, and other groups underrepresented or unrepresented in earlier studies, have also been important concerns (Ferguson, 1992; Gero and Conkey, 1991; Joyce, 2009).

For all its constantly shifting and diverse paradigms, postprocessual archaeology has made three positive and important contributions (Hodder, 1999):

1. Meaning is more important than materialism. No longer can archaeologists interpret the past in terms of purely ecological, technological, and other material considerations. Culture is interactive. In other words, people are actors who create, manipulate, and remake the world they live in.
2. Archaeologists must critically examine their social responsibilities, looking beyond their specialties to the broader aims of the discipline and to issues of moral and emotional involvement with the past in modern society. How does the public interact with the past?
3. There are many perspectives on ancient society that have been neglected, among them those of women, ethnic minorities, and anonymous, often illiterate commoners—often called “people without history.” In other words, the past has many voices, not just one (Hodder, 1999).

In the final analysis, postprocessualism is a logical development of earlier theoretical approaches. (For an advanced and closely argued critique, see Hodder et al., 2007.)

Some Schools of Archaeological Theory

To varying extent, the just-discussed approaches to the interpretation of the past remain with us today. Rather than replacing one with another, today's archaeology embraces myriad theoretical approaches. Culture-historical, processual, and postprocessual archaeologies can be thought of as major, overarching paradigms about how the past should be conceptualized, how to evaluate archaeological data, and what the objectives of archaeological research should be. To see these as rigidly divided schools of thought is misleading, for in practice each often takes something of the other. (For a discussion of the radical differences in new explanatory paradigms, see Bintcliff, 2004.)

To explain past cultures, researchers also draw on a variety of other theories and concepts to model social, economic, political, and cultural systems and to contextualize their work. Many of these theories come from philosophy and cultural anthropology, but sociology, political science, evolutionary biology, and even literary criticism have also been employed as sources. These varying perspectives help archaeologists conceptualize and model past social systems. Although some may be better suited to processual or postprocessual views of the past, none can be easily compartmentalized. For example, while much of processual archaeology may have grappled with human adaptation to the environment, the interpretation of past ideology, religion, and worldview are of central concern to the **cognitive-processual approach** (Flannery and Marcus, 1993b). Gender roles have also been the focus of both processual and postprocessual researchers (Hays-Gilpin and Whitley, 1998). Theoretical approaches to archaeology are numerous; among them are the following.

Evolutionary approaches have been integral to archaeology since the nineteenth century. While the idea of the unilinear evolution of human societies has been discarded (see [Chapter 2](#)), the concept of multilinear cultural evolution is inextricably linked with modern archaeological research. This is a useful way of conceptualizing change in past societies (see Earle, 1997).

Some researchers have also employed ideas of evolutionary processes to examine social and cultural adaptations, as well as adaptations to the natural environment. Archaeologists of this persuasion maintain that natural selection constrained human thought and action. Consequently, the way in which people behave can be understood by understanding

the constraints placed on the human mind during its long evolutionary heritage. From this viewpoint, natural selection produced culture by conferring a reproductive advantage on its bearers. Thus, thought and action were channeled by natural selection in directions that were adaptive for an evolving *Homo sapiens* (Mithen, 1996). The legacy of natural selection is a tendency for humans to think and act in certain ways and not in others. The result is a trend toward conformity in thought and action among very diverse human societies with very different institutions and beliefs.

Ecological approaches stress the study of ancient societies within their natural environments. As seen in the discussion of cultural ecology, culture change as an adaptation to the environment emerged as an important area of study in the mid-twentieth century, and it was subsequently important in the emergence of processual archaeology, which primarily saw culture as an **extrasomatic** adaptation to the environment (Crumley, 1994).

Marxist perspectives, based on the writings of Friedrich Engels and Karl Marx, have also had a strong influence on archaeological theory. Classical Marxist perspectives stress the contradictions between economic relations (especially production and exchange), class conflict, and inequality as the primary forces behind sociocultural evolution. Marx and Engels saw the unilinear evolutionary framework outlined by Lewis Henry Morgan (discussed in [Chapter 2](#)) as a model for the evolution of ancient human societies, just as their own work detailed the evolution of capitalism, socialism, and communism. V. Gordon Childe was influenced by Marxist perspectives, which focused on major changes (or revolutions) in the relations of productions, such as occurred with the transition to agriculture and the rise of sociopolitical complexity, to understand changes in social organization (Trigger, 1980).

Some researchers turn to Marxism for framing their discussions and for analytical concepts, some introduced by Marxist scholars such as Antonio Gramsci, H. Lefebvre, and Claude Meillassoux (McGuire, 1992). Dialectical Marxism, for example, underscores an understanding of the interconnected relationships among phenomena within a society. Hence, subsistence, gender, class, and race are seen as integrated parts of the entire social system, rather than independent constructs. Marxist perspectives and analytical concepts have been very important for

historical archaeologists examining the archaeology of capitalism and the expansion of Europe into the non-Western world (Orser, 1996). Another branch of Marxist archaeology focuses on the modern contexts in which archaeologists operate and is integral to critical archaeology.

Critical archaeology assumes that because archaeologists are actors in contemporary culture, they must have some active impact on society (Shanks and Tilley, 1987a, 1987b). One extreme is the Marxist view of archaeology, which states that all knowledge is class based, so archaeology composes history for class purposes. Thus, reconstructions of the past have a social function and, consequently, archaeology cannot be a neutral, objective science. By engaging in critical analysis, an archaeologist can explore the relationship between a reconstruction of the past and the ideology that helped create that reconstruction.

Critical archaeology is a process of archaeologists becoming more critical of their own place in the unfolding intellectual development of Western scholarship (Trigger, 2006). Much critical archaeology focuses on understanding the pasts of people who have been “denied” a history women, blacks, nonliterate societies, and so on. In other words, we should be concerned with the cultural baggage of our work.

Cultural materialism is derived from Marxist perspectives, but the role of subsistence and subsistence technology as the principal source of sociocultural phenomena is emphasized. At the base of all sociocultural phenomena is the infrastructure, which includes the means of subsistence and basic needs such as food, clothing, and shelter. These phenomena exert selective pressures on the rest of society, including family structure, division of labor, class, religion, science, customs, and ideologies (Harris, 1999). Although other cultural phenomena may influence cultural evolution, infrastructural factors are viewed as being far more important.

Cultural materialism is especially attractive to archaeologists because it stresses technology and the environment, aspects of past societies that survive well in the archaeological record and can be evaluated.

World systems theory, developed by sociologist Immanuel Wallerstein (1974, 1979), maintains that the socioeconomic differences among societies are the product of an interlocking global economy. All societies are placed in one of three general categories: Core societies are powerful industrial nations that dominate other regions or nations,

semiperipheral societies are somewhat industrialized but lack the power of the core, and peripheral societies lie outside the core and can do little to control the economic expansion of the core. Relationships between industrialized and developing countries in the modern world are seen in terms of core–periphery relations.

Not surprisingly, world systems theory has provided an important model for historical archaeologists examining the intersection of Europe with the non-Western world (DeCorse, 2001). However, archaeologists working on precapitalist societies have also found some of the concepts useful in examining the relations in older, smaller “world systems,” such as the emergence of sociopolitical complexity in Mesopotamia and Mesoamerica (Chase-Dunn and Hall, 1991).

From an archaeological perspective, the term **cognitive archaeology** covers the spectrum of human behavior, especially religion and belief, but also the development and expression of human consciousness, sometimes called the “archaeology of mind.”

Some archaeologists employ a cognitive-processual approach, with a new framework for archaeology drawing on both old and new models and methods. It stresses the careful evaluation of data that characterize processual archaeology. Cognitive processualists never claim that they can establish what people thought, but they can gain insights into how they thought (Renfrew, 1993, 2005).

Structural approaches (structural archaeology) treat human cultures as shared symbolic structures that are cumulative creations of the human mind. In other words, people think and order their world by using similar “central, powerful, and pliable symbols” (Leone et al., 1987). Structural analyses aim to discover these universal principles of the human mind, an approach associated in particular with French anthropologist Claude Lévi-Strauss. They are an attempt to get at the conscious and unconscious of human thinking. Lévi-Strauss (1966) argued that human thinking is based on binary oppositions; that is, we classify things into opposing types—hot and cold, raw and cooked, nature and culture. These binary contrasts, argue the structuralists, are found in all societies, and can be identified through analysis.

The cognitive-nonmaterial nature of structuralism makes it difficult to examine in the material record, and consequently, structuralism has had limited application in archaeology. However, some post-

structuralists are less concerned with cultural universals and focus more on the cognitive structure within individual societies (Kirch and Sahlins, 1992). Archaeologist Ian Hodder studied the Nuba agriculturalists of the Sudan and showed that all aspects of their material culture, including burial customs, settlement patterns, and artifact styles, could be understood in the context of a set of rules that perpetuated their beliefs in “purity, boundedness, and categorization” (1982). Thus, Nuba society is the result of structured, symbolizing behavior, and has fundamental utility. But it also has a logic of its own, which generated the material culture that is observed by the archaeologist.

What Lies Ahead?

Where does archaeological theory stand at the moment, and where is it going? These are difficult questions, which are linked to major changes in how archaeology is perceived both in academia and outside it. Virtually every archaeologist would now agree that we are unavoidably influenced in our work by our social and political circumstances—that is, our “cultural baggage.” At the same time, archaeology is now a global enterprise, practiced by archaeologists with very different cultural backgrounds and theoretical perspectives. This means that there will never be an overarching theoretical viewpoint, but many of them. However, archaeologists everywhere agree on one thing: Data is central to our work.

We Tend to Be Empirical

Our data set is extremely important, for it is the filter against which we test our theoretical models. Matthew Johnson (2010: 217) defines theory very simply as “the order you put facts in,” a very broad definition to be sure, but one that draws attention to the way in which theory and data are closely related. Both are part of a larger whole—one cannot understand the one without the other.

Many archaeologists still believe that data speak for themselves, that they are too busy to consider theory. They believe one can choose between adopting or not adopting a theoretical approach, some of

which are more empirical than others. This is nonsense, of course, for whether we like it or not, we are all theorists. You cannot look at archaeological theory from the outside as something separate. There are many theoretical positions you can take, but whatever the position, you are still part of a broader community of archaeologists, a body of people with increasing cultural diversity. Most of us love digging, handling artifacts, and “listening” to our finds talking to us, which is the heart of a strong empirical tradition within archaeology. It will always be a strong part of archaeology and will always affect theory.

Multivocal Archaeology

For example, the relationship between archaeologists and indigenous peoples, both in North America and in other places, such as Australia and New Zealand, has undergone complete transformation within the past quarter-century. In many cases, there has been a sharp dividing line between how archaeologists construct the past and the beliefs held by indigenous people, who had typically once been denied a voice, a topic we touched upon in [Chapter 1](#). This is now changing slowly. At the other end of the spectrum, some far-right sections of British society have recently claimed the label “indigenous,” arguing “the whites” also need a voice; but while everyone certainly does deserve a voice, theirs has been used to make violent claims on ownership of land and labor with powerful undertones of nationalism that take on unpleasant fascist and racist tones. Thus, archaeological theory operates in many contexts, so it follows that there are now many different ways in which archaeologists, whether academics or professionals, think of theory and use it. This is part of what Ian Hodder (1999) calls a “multivocal” archaeology, “flows of the past, continua of interpretation” (see the Site box on page 56). He thinks that archaeology is a way of breaking established patterns of thought and domination in the twenty-first century.

Archaeology is a curious social science, since archaeologists are “unable either to observe human behavior or to learn about human thoughts at first hand from their primary data,” wrote Bruce Trigger (1991). Therein lies the crux of many theoretical debates (Johnson, 2010; Preucel and Mrozowski, 2010). Today, processual and postprocessual

archaeology flourish alongside one another. Processual archaeology is most successful in dealing with long-term constraints on culture change and larger-scale social structures. Such topics, as well as hunter-gatherer and farmer settlement studies, are well suited to broader, often dispassionate analysis based on statistical data. In recent years, processual archaeology has become less narrowly focused and is now examining broader issues of change that consider such topics as humans as part of the natural environment. Postprocessual advocates tend to focus on individuals and small groups, on “interpretation, multivocality, meaning, agency, history” (Hodder, 1999). Such themes are best studied in complex historical societies for which a great deal of written and archaeological information is available, or when researching cultural heritage for social purposes. In many respects, we are at a moment when theoretical debates are moving beyond competing schools of thought, such as processualism and postprocessualism into consideration of several common themes. These include agency materiality and the widening role of theory.

Agency In recent years, we have seen an explosion of interest in individuals, individual histories, and the ways in which individual variation and cultural innovation interacts with the wider population. Factionalism in, say, Ancient Egyptian royal courts, changing gender roles, and so on, is becoming a major factor in our efforts to explain such issues as the emergence of social complexity and state-organized societies. Archaeology, by its nature, tends to be anonymous and nameless, to the point that we sometimes claim that we cannot identify individuals. Fortunately, it is surprising how often we can, through such prosaic clues as pottery styles and, more recently, through isotopes and other fine-grained dissection of skeletal remains and other finds (see [Chapter 16](#)). We can talk as much as we wish about cultures, phases, and other such arbitrary classifications, but such groupings steer us away from simple human actions, such as building a fire, shaping a bone awl, or carving a figurine.

Materiality The material world is important. Objects of all kinds mediate social relationships. They are active and change humans. The relationship between people and things is complex but important. It

follows that such things as buildings, temples, artifacts, and landscapes are not simply passive reflections of other aspects of human culture.

The Widening Role of Theory Archaeology is a field activity and is concerned with materiality. Some of the widening theory is occurring in the field, notably with Ian Hodder's long-term excavations at Çatalhöyük (see Site box on page 56), where the fieldwork is flexible (Hodder, 1999: 691), and there is a concern with the different stakeholders in the site—local and cultist, academic and heritage authorities, to mention only a few. There is also a growing concern with such issues including heritage, landscape, diversity, and so on in recent years. Much of this emerging concern comes from governmental bodies such as English Heritage and the National Park Service, also from repatriation legislation such as the Native American Graves Protection and Repatriation Act (NAGPRA), which has had a major impact on American archaeology (see [Chapter 18](#)). At the same time, new realities—for example, universal technologies such as the internet and burgeoning global tourism—engage archaeology more closely with the contemporary world. On the other hand, environmental deterioration, the rapid destruction of archaeological sites, and the responsible management of cultural resources will likely be of increasing concern. Archaeologists can no longer afford to live in academic ivory towers, divorced from the contemporary world.

S i T E > Çatalhöyük, Turkey, circa 7000 B.C. <

In 7000 B.C. , Çatalhöyük, in central Turkey, was one of the largest communities in the world and has consequently been dubbed “the earliest city in the world.” In fact, the settlement was a large village or small town of numerous small houses built of sun-dried brick. These were constructed to back onto one another and occasionally separated by a courtyard (see [Figure 3.6](#)). The outside walls of the flat-roofed houses served as a convenient defense wall.

The village was rebuilt at least 12 times after 7000 B.C. and owed its size and increasing prosperity to agriculture and widespread trade in obsidian (volcanic glass) quarried in nearby mountains. Obsidian was widely prized for its tool-making qualities and was often used for ornaments because of its beauty. Volcanic glass from Turkish quarries

has been traced deep into Syria and along the eastern Mediterranean coast (see [Chapter 16](#)).

British archaeologist James Mellaart (1967), the site's first director, dug a series of houses and remarkable village shrines in the site that tell us much about the religious beliefs of the inhabitants. The shrine walls bear friezes of vultures and ancestors, scenes of birth and shamanistic dances, and sculptures depicting women or bull's horns. We know little of the religious beliefs at Çatalhöyük, but the people worshiped a female deity who may have been a form of mother goddess, and they clearly revered their ancestors.

Since 1993, Ian Hodder, and an international team of researchers returned to the site and have been excavating Çatalhöyük as a long-term project, using a multidisciplinary perspective and innovative methods that address both the theory of excavation and many basic issues in postprocessual archaeology (Hodder, 1999).

Çatalhöyük promises to be one of the most important excavations of the early twenty-first century, both because of its innovative methodologies and because it will provide unique information on the early religious beliefs and ideologies of Stone Age farmers. The initial work by Mellaart is a good example of the importance of establishing a chronological framework, and also of some of the archaeological data that may be used to infer past religious beliefs. The ongoing work by Ian Hodder underscores postprocessual ideas about the importance of the modern context in which archaeologists work and the subjective perspective of the excavators.

[Figure 3.6 Excavation of a house complex at Çatalhöyük, Turkey.](#)

Source: Courtesy of Images & Stories/Alamy Stock Photo.

Theory: Like a Visit to the Dentist?

Ideally, we should be moving on from a merging of processualism, postprocessualism, and theoretical debates that are outmoded and tired. We suspect that we're not at a moment where a major shift in how archaeologists go about their business. Archaeological theory is becoming broader, as we develop new ways of thinking about the past and become more involved in contemporary societies of all kinds. But

behind these fresh theoretical ideas lies the basic pragmatic archaeology in all its sophistication that will always be the foundation for our changing understandings of the past. This is the most important theoretical task that faces us: asking new questions about what happened in ancient times. This is easier said than done, but all archaeologists, whatever their interests and concerns, should reflect on what they do, both as scholars and as human beings. Theory should challenge our daily work and encourage us to think and act in new ways (see Harris and Cipolla, 2017). This, quite simply, is the future of archaeological theory. With its myriad of often remarkable scientific methods, many of which are described in this book, archaeology for its practitioners can become a specialized, rewarding way of making a living and studying the past. We have a choice: take our archaeological lives for granted, or constantly question the discipline of which we are part—and that is what theory is all about. Theory helps produce a more accurate and stimulating perspective on the past, which is of value to society and humanity as a whole. Theory is an essential part of modern archaeology (Lucas, 2012). Matthew Johnson (2010: 235) likens it to a visit to the dentist. To argue whether or not it is some sort of necessity is to miss the point. And in any case, unlike a visit to the dentist, it can (sometimes) be enjoyable. We'll explore some of the latest theoretical ideas later in the book, but before doing so we must explore the basics of archaeology that make all this possible.

Summary

1. Interpretation in modern archaeology has gone through dramatic changes since the 1950s. Based on a culture-historical foundation, a variety of processual and postprocessual perspectives are now employed by archaeologists. These represent very different ideas about the objectives and potential of archaeological research.
2. The process of synthesis in culture history is based on constructing precise chronological sequences. Interpretation depends on analogy and descriptive cultural models that are used to identify variables that operate when culture change takes

place.

3. These models include inevitable variation, cultural selection, invention, diffusion, and migration. They may provide a useful means of describing what happened in past societies, but, in themselves, they do not explain culture change.
4. In the 1960s, Lewis Binford formulated new approaches to archaeology using explicitly scientific methods. He emphasized the evaluation of archaeological data using formal hypotheses and clearly stated research designs for planning all inquiries. He also drew on statistical methods long used in the natural and physical sciences. Binford's "new archaeology" was the basis of processual archaeology.
5. Processual archaeology embraces a systems-ecological approach that deals with the ways in which cultural systems function, both internally and in relation to external factors such as the environment. This approach is based on general systems theory, cultural ecology, and multilineal cultural evolution.
6. Some archaeologists rebelled against the somewhat anonymous, impersonal depictions of the processes of culture change engendered by the processual approach. Postprocessual archaeology developed as a reaction against the ardent materialism of processual archaeology.
7. Postprocessual archaeologists point out that archaeology is the study of human behavior, individual as well as collective. People are actors, they argue, who assume an active role in shaping their culture and society.
8. Some postprocessual approaches underscore the role of archaeology within modern society and the multivocal archaeology of individuals and groups.
9. Today's archaeology consists of a variety of theoretical perspectives and approaches that share aspects of culture-historical, processual, and postprocessual archaeology. The archaeology of the future cannot afford to remain aloof from a real and increasingly networked world, where many humans can contribute to new models of the human past.

Further Reading

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PART II

THE BASICS

Excavators, as a rule, record only those things which appear to them important at the time, but fresh problems in archaeology and anthropology are constantly arising... . Every detail should, therefore, be recorded in the manner most conducive to facility of reference, and it ought at all times to be the chief object of an excavator to reduce his own personal equation to a minimum.

—General Augustus Lane Fox Pitt Rivers, *Excavations in Cranborne Chase*, 1887

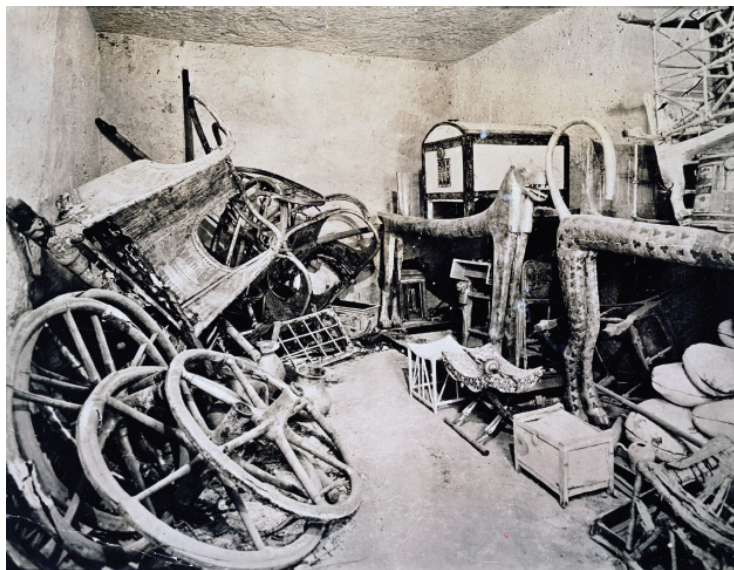
Part II describes the basic processes and principles of archaeological research. How do archaeologists carry out their research? What are the essential principles behind archaeology? These chapters define the archaeological record, look at factors that affect it, and examine the concept of culture in archaeology, the nature of archaeological data, and the ways in which people have established archaeological contexts. Fundamental to context are methods of defining human activities in space and, especially, of measuring prehistoric time. We also survey the various methods used for dating prehistoric cultures.





















Matrix and Preservation

CHAPTER OUTLINE

Archaeological Data

Site Formation Processes

The Matrix: Preservation and Human Activity

Preservation Conditions: Inorganic and Organic Materials

Organic Materials and the Archaeological Record

Chimu ceremonial gold gauntlets from the northern coast of Peru, circa twelfth to thirteenth centuries A.D.

Source: Courtesy of Stock Connection Blue/Alamy Stock Photo.

Archaeologists study all past human behavior, principally by using surviving material remains. The archives of this past are archaeological sites and artifacts, food remains, and many other categories of finds that make up the **archaeological record**. As already mentioned, this record is finite and easily destroyed. Even under the best preservation conditions, the record is incomplete, but it is the basis of all research—particularly into the remote prehistoric past. Our discussion of the basic principles of archaeology begins with this record of sites, artifacts, and other phenomena. This chapter discusses the makeup of the archaeological record. We describe the complex and still little-understood processes that affect the abandoned artifacts, structures, and sites of our forebears.

Archaeological Data

Archaeological data consist of any material remains of human activity—a scattering of broken bones, a ruined house, a gold mask, a vast temple plaza. Archaeological data result from two processes. One is human behavior, the result of human activity. The other is what are often called transformational processes. The archaeologist identifies and reconstructs ancient human behavior, such as the occupation of a hunter-gatherer camp. The band decides on a location, gathers building

materials—sticks, brush or sod, mammoth bones—erects a dwelling, occupies it, and then destroys or just abandons the settlement. Archaeologists reconstruct sequences of ancient human behavior not only from archaeological data but also from the circumstances under which they are found.

Human behavior is the first stage in the formation of the archaeological record. But what happens when the site is deserted? The collapsed brush shelters, a scattering of stone tools, the remains of a ceremony are abandoned, being of no further use to their owners. All manner of natural processes take hold. The bodies of the buried dead decay; toppled shelters rot away in the sun. Subsequently, a nearby lake may rise and cover the remains, or windblown sand may accumulate over the stone artifacts. Another group may come and build a farming village on the same spot or may simply reuse some of the artifacts left by the earlier occupants.

All of these cultural and noncultural developments are transformational processes—continuous, dynamic, and unique processes that vary with each archaeological site. Of course, there are wide differences in the preservation of various artifacts, raw materials, and other finds. Thus, the archaeologist's data are always biased and incomplete, altered by a variety of transformational, or site transformation, processes. It follows that anyone investigating an archaeological site has to look closely at both natural and human agents of transformation. For example, humans have devastated a large number of ancient sites in Syria and beyond in recent uprisings, whereas the wet conditions in Scandinavian bogs have preserved prehistoric corpses in excellent condition.

Site Formation Processes

The objects from the past that survive come down to us in two forms, either as historically documented artifacts, such as Orville and Wilbur Wright's first airplane, or in the archaeological record as culturally deposited artifacts that are no longer part of a living society. This past, in the form of artifacts, does not come to us unchanged, for complex processes have acted upon these objects, be they tools, dwellings, burials, food remains, or other human-manufactured or human-

modified items. In their study of these artifacts, archaeologists must also untangle the many events and processes that contributed to the great variation in the archaeological record as we know it today (Schiffer, 1987).

The factors that create the historical and archaeological records are known as **site formation processes**. Site formation processes are those agencies, natural or cultural, that have transformed the archaeological record since a site was abandoned. There are two basic forms of site formation processes—cultural and noncultural.

Cultural transformations are those in which human behavior has transformed the archaeological record. They can vary widely in their impact and intensity. For example, later occupants of a site that was a hunter-gatherer camp in southwestern Asia may have been farmers and goat herders rather than hunters. The foundations of their houses cut deeply into underlying strata, and the hooves of their penned goats trampled on and scattered small stone artifacts lying on the surface. And, of course, the archaeologist's excavations are cultural processes, too.

On a more specific level, people reuse artifacts—to conserve precious tools and valuable raw materials—changing the use of an artifact from a knife to a scraper, recycling a projectile point to another use. Sometimes prestigious or valuable objects become prized heirlooms passed down from generation to generation or buried with the dead, as soapstone pipes and other precious artifacts were with Hopewell kin leaders in the Midwest more than 2,000 years ago. Reuse, especially of commodities such as building materials, can become a potent factor in settlements that are occupied for long periods, where people recycle old bricks and other materials for new dwellings. Then there is the dumping of trash, some of it underfoot, much of it elsewhere in secondary locations where trash heaps may form. These heaps often tend to cluster in specific locations—perhaps a convenient, abandoned storage pit or an old dwelling—that can be used for many generations. Disposal of the dead can be viewed as another form of discard behavior. The archaeologist must decipher the complicated behavioral processes—the logic, if you will—behind the accumulation of trash heaps, the disposal of the dead, and many other activities. In short, the archaeological record is not a safe place for artifacts, for myriad human activities can

disturb them after deposition—plowing, mining, digging of foundations, clearing land, artillery bombardment, to say nothing of pot hunting or site looting, including the large-scale looting that is happening in the current conflicts in Syria and beyond.

Noncultural processes are the events and processes of the natural environment that affect the archaeological record. The chemical properties of the soil or bacteria may accelerate the decay of organic remains, such as wooden spears or dwellings, or may even increase the chances of superb preservation. Rivers may overflow and inundate a settlement, mantling the abandoned remains with fine silt. A massive earthquake can topple a settlement in a few minutes, as happened to the Roman town at Kourion in Cyprus on July 21, A.D. 365 (Soren and James, 1988). Windblown sands, ice disturbances, and even the actions of earthworms can disturb the archaeological record.

Whether site formation processes are cultural or noncultural, the important point is that the archaeological record can never be taken at face value. In other words, what you see in the ground is not necessarily a direct reflection of human behavior. In recording, analyzing, and interpreting the archaeological record, the archaeologist must also consider and investigate the formation processes that altered the record from the moment of its deposition.

Site formation processes are always important in archaeology, but they assume special importance when it is necessary to document precise associations between, say, human activity and extinct animals. This necessity is especially evident in the ongoing debates about the date of the first human settlement of the Americas (Meltzer, 2008). The earliest, well-attested occupation of the Americas dates to about 15,000 years ago, perhaps a couple of millennia earlier, documented by an archaeological record that is beyond question. It is a different matter with earlier claims, claims as early as 40,000 years ago or more, notably from sites in South America. The Boqueirão da Pedra Furada site in northeastern Brazil is claimed to contain evidence of human occupation, including hearths, dating to before 40,000 years ago. However, the excavators failed to scrutinize the site formation processes that acted on the artifacts from the lower levels of the site (Guidon and Delibrias, 1986). Natural geological phenomena such as water action, which filled the lower levels of the cave, resulted in the appearance of a

32,000-year-old occupation and associated artifacts (Meltzer et al., 1994).

The natural environment is a hostile place for human artifacts, for the process of interacting with it causes deterioration and drastic modification of the many properties of artifacts, affecting everything from color and texture to weight, shape, chemical composition, and appearance. The environmental agents of deterioration can be grouped into chemical, physical, and biological categories, and some agents produce more than one type of change; for example, water and sunlight produce both chemical and physical changes (Schiffer, 1987).

Chemical agents are universal, for the atmosphere contains water and oxygen, which create many chemical reactions; corrosion of some metals is an example. Different water temperatures, irradiation of materials by sunlight, and atmospheric pollutants all cause chemical reactions. Buried objects are often subject to rapid chemical change, especially as a result of dampness. Soils also contain reactive compounds, such as acids and bases, that contribute to many deterioration processes. Acidic soils dissolve bones, for example. Many archaeological deposits are somewhat salty, a condition caused by salts derived from wood ash, urine, and the neutralization of acids and bases. Such saline conditions can retard some decay, but they can severely accelerate the decay of copper, iron, and silver.

Physical agents of deterioration are also universal: water, wind, sunlight, and earth movement. Water is especially potent, for it can tumble artifacts on the shores of oceans or lakes or from riverbank encampments, sometimes even fracturing them in ways that suggest human manufacture. Rainwater can cascade off roofs and tunnel deep grooves into walls. The cycle of wetness followed by drying cracks many woods and causes rot; melting and freezing ice cracks rocks, even concrete. Physical agents operate on scales small and large. For example, the Kourion earthquake flattened the small port and also affected the landscape for miles around.

Living organisms are the main agents of biological decay. Bacteria occur almost everywhere and are usually the first to colonize dead organic matter and begin the processes of decay. Fungi also occur widely and are especially destructive to wood and other plant matter, particularly in damp, warm climates. Beetles, ants, flies, and termites

infest archaeological sites, especially middens and abandoned foods. Animals such as dogs and hyenas chew, gnaw, and scavenge bones and other organic materials from the surfaces of abandoned sites and game kills.

In summary, archaeological sites are affected by all the processes within their natural environment. The first human activity at any site took place on a natural surface, on natural sediments themselves sitting on underlying bedrock. Sometimes this underlying sediment was weathered over a long time and may contain pollen grains, plant remains, or other sources of environmental information. For instance, some Bronze Age burial mounds in Europe were erected on undisturbed soils that contained forest pollen grains, giving a picture of the local environment at the time of construction (see [Chapter 12](#)). After a site is abandoned, additional sediments usually accumulate on top of the archaeological remains through the action of wind or water, such as the windblown sands that accumulate in the rooms of Southwestern pueblos. Human feet or animal paws, burrowing animals, earthworms, wall flakings from overhanging cliffs, and the deteriorating elements of artifacts and structures contribute to the alteration of archaeological deposits. Rock shelters in southwestern France, for example, were occupied intermittently by hunter-gatherer groups between 30,000 and 15,000 years ago. Some of the larger ones contain densely packed layers of hearths, ash accumulations, boulders, and decaying structures. Untangling how these levels were formed is a complex process.

DISCOVERY ERUPTION AT AKROTIRI, GREECE, CIRCA 1688 B.C.

Only rarely do archaeologists find sites associated with direct evidence of ancient climatic or natural phenomena. A half-century ago, Greek archaeologist Spyridon Marinatos speculated that the flamboyant Minoan civilization of Crete was severely damaged by a huge volcanic eruption that blew the center of the island of Santorini (Thera), 62 miles (100 km) north, into space in about 1688 B.C. Few archaeologists agreed with his theory. Undeterred, Marinatos searched diligently for Minoan sites on Santorini but he found that everything was buried under

massive volcanic ash deposits. In 1967, he heard reports from farmers of masses of stones close underground in the fields around Akrotiri in the south of the island. So dense were the boulders that the farmers could not plow their land. Marinatos began digging into places where the ground had collapsed between the subterranean masonry and promptly discovered the Greek city of Pompeii, an island town of 3,500 years ago, completely buried by pumice and ash when the volcano erupted.

Akrotiri's houses are remarkably well preserved, their stone and timber walls often two stories high. Brilliant polychrome frescoes still adorn some of the rooms, depicting religious and military scenes, the island landscape, animals, and plants (Figure 4.1). Food storage jars still stand in the basements of the houses. But there was no trace of the inhabitants, who had fled when ominous subterranean rumblings began. The imported Minoan pottery at Akrotiri is at least 20 to 30 years earlier than that from the latest levels of Cretan villages, proving that Marinatos was wrong. The Santorini eruption did not destroy Minoan civilization.

Figure 4.1 Fisher boy with his catch. A wall painting from Akrotiri, Santorini Island, Aegean Sea, Greece.

Source: Courtesy of DEA/G. Nimatallah/De Agostini/Getty Images.

The site formation processes at each individual site must be considered separately, usually in the context of the different deposits within the site. The first stage is to identify the specific cultural and noncultural **transformation processes** that created each deposit or set of deposits. This identification involves thinking of the artifacts as an integral part of the deposits in which they are found. The investigator records and analyzes such phenomena as reductions in size, patterns of damage, and distribution within the deposit as clues to understanding the complex “package” of materials that make up that deposit. In other words, the archaeologist has to establish what cultural and noncultural processes led to the formation of each deposit in the site.

The fundamental point about studying site formation processes is that they have to be identified before behavioral or environmental inferences can be made about any archaeological site. Identifying specific site formation processes is difficult, even under ideal

circumstances, and involves not only geological research but also data acquired from ethnoarchaeology, controlled experiments, and other sources. It is not enough, then, to observe conditions of unusually good preservation or to describe the complex layers of a prehistoric rock shelter. One must also analyze and interpret the ways in which the archaeological record was created through site-formation processes.

The Matrix: Preservation and Human Activity

All archaeological finds, from a humble worker's stone chopper to an Egyptian pharaoh's tomb, occur within a **matrix** (the physical substance that surrounds the find). This is formed by natural phenomena such as a river flood, or from human behavior such as the decision to destroy and then build a new structure on top of an older one. The chemical and physical characteristics of the matrix can have a profound effect not only on the **provenance** (the precise three-dimensional position of the find in the matrix as recorded by the archaeologist) of an archaeological find but also on its context and association with other subjects. For example, the physical characteristics of the deposits in which dozens of Stone Age hand axes were found tell us that fast-running waters of the River Thames in England rolled them downstream from where they were originally dropped by their makers and deposited them in river gravels, to be recovered by archaeologists more than 250,000 years later. Human behavior also determines the context and provenance of archaeological finds in the matrix. Many Hopewellian culture burials of 1,800 years ago were deposited in mound platforms in the Ohio Valley. Careful excavation of the surrounding deposits shows that many people were laid to rest before a large earthwork was erected over the sepulchral platform where the dead lay (Fagan, 2011).

Evaluating the natural formation processes that have contributed to the archaeological record usually involves geological and archaeological research combined. Deciphering human activities from artifact patterns in the matrix requires careful evaluation of many subtle behaviors from the remote past. The following are some common instances of human activity that affect the archaeological record.

Discarding

The patterns of artifact discard can be very subtle; understanding them often requires knowledge that is still beyond our grasp. For example, at the Maya trading center on Cozumel, off the coast of the Yucatán Peninsula, the people invested very little material wealth in temples, tombs, or other permanent monuments (Freidel and Sabloff, 1984). Their capital in obsidian (volcanic glass) was kept fluid and on hand, an investment in resources different from that found at other Maya ceremonial centers, which invested heavily in religious monuments and tangible displays of wealth. The different investments in resources reflect the activities and their significance in each type of locality. Deciphering such patterns of discard—the remains that are left for interpretation after the long centuries and millennia of natural destruction have taken place—presents huge difficulties for archaeologists.

Recycling

People discard artifacts, and they recycle them as well. A stone ax can be sharpened again and again until the original large artifact is just a small stub that has been recycled into extinction. It takes a great deal of effort to build a mud-brick house from scratch. Very often, an old house is renovated repeatedly, its precious wooden beams used again in the same structure or in another building. Such recycling can distort the archaeological record, for what appears to be a one-time structure might in fact have been used again and again. The frequent reuse of wooden beams complicates tree-ring dating of pueblos in the Southwest. Sometimes, too, the Pueblo Indians would cut beams and stockpile them for later use. Norse settlements in Greenland yield large numbers of iron nails, many of them recycled from wooden ships where the timbers have been burnt for firewood and the fastenings retained for trading with the Inuit in Baffinland. Alternatively, when digging in Yemen, one of us (Nadia Durrani) would occasionally note what appeared to be Iron Age limestone blocks and decorative stones recycled into the walls of today's village houses. This still-active reuse of millennia-old material illustrates just how far ancient recycling might distort our interpretation of the archaeological record.

Not only individual artifacts but also entire archaeological sites can be recycled. A settlement flourishes on a low ridge in southwestern Asia. After a generation or two the site is abandoned, and the inhabitants move. Later, people return to the site, level the abandoned houses, and build their own dwellings on top of the site. This type of recycling can seal and preserve earlier levels, but it can also result in the reuse of building materials from earlier houses.

***Doing Archaeology* Excavating an Exceptional Bronze Age Site: Must Farm, England**

Very occasionally, archaeologists uncover a site that upends our perceptions of an entire era. Such is the case for Must Farm, an extraordinarily well-preserved settlement dated to the Late Bronze Age (1000–800 B.C.).

Nestled on the edge of a working quarry in the waterlogged Fenlands of Cambridgeshire, England, excavations in 2015–2016 revealed five Bronze Age roundhouses at Must Farm. Such dwellings are not, in themselves, rare. Many are known from across Europe—usually represented by dark stains in the earth where their wooden posts once stood. Sometimes, one might even find stunted dwarf stone walls, as at Dartmoor, also in the UK. The astonishing difference about Must Farm is that the site contains the entire remains of Bronze Age houses—plus all their contents. As is often the way with archaeology, a past catastrophe led to this outstanding discovery.

It seems that at some point, perhaps just six months after the settlement was established, a fire took hold at the farm. The houses had originally been raised up on stilts, set over a sluggishly flowing watercourse, deep in the soggy Fenlands—but as the fire raged from wooden house to wooden house, the timber platforms collapsed, plunging the houses and all their contents into the water. The flames were extinguished on contact, and the riverbed was littered with the scorched ephemera of everyday life—including baskets, spindle whorls, exquisitely woven textiles, the largest and best-preserved Bronze Age wheel ever found in Britain ([Figure 4.2](#)), querns, pots, beads, metal spears and tools, and even uneaten vitrified servings of stew. These objects were then further sealed by the charred and waterlogged roof

structures. Over time, layers of nonporous silt then covered the whole lot. Ultimately, everything then lay untouched by human hands for the next approximately 3,000 years.

Once the archaeologists began work on this Bronze Age “time capsule,” great surprises lay in store. During initial exploratory soundings, researchers had identified such a wide array of metalwork that they assumed it must have been amassed for ritual use. Yet subsequent excavations revealed it was all simply part of a domestic assemblage, demonstrating that metal equipment was far more widely available in the Bronze Age than had previously been imagined.

Subsequent and ongoing post-ex analysis of the finds is shedding yet more light on everyday items of the era, and also on the activities in and around Bronze Age roundhouses. Among the revelations has been the reliance by the people of wetland Must Farm on dry-land resources, both in terms of the house timbers and the food they ate. Archaeologists had previously accepted that groups who colonized such fenland environments would have relied on fish and fowl, but we now know that the folk at Must Farm also ate cereals, mutton, pork, and beef. These were clearly not isolated groups but people who were plugged into a much wider economic and social network. Indeed, this site further illustrates just how wide ranging such links were, with evidence for connections with Spain, northwest France, and the Balkans. Must Farm is revealing how even an assumed “isolated backwater” was, in reality, part of a widely connected and interdependent world. It will take years for the postexcavation analysis to be complete, but the site has already revolutionized what we thought we knew about this era.

Figure 4.2 Archaeologists working at the c. 3,000 year-old site of Must Farm. The archaeologist is uncovering a wooden wheel: at 3.2 feet (1m) across with its hub still intact, it is the earliest complete example of a Bronze Age wheel ever found in Britain.

Source: Courtesy of Jada Images/Alamy Stock Photo.

Preserving Ceremonial Artifacts and Heirlooms

Successive generations may find a structure or an artifact so valuable that they consciously preserve it for the benefit of their descendants.

The 196-foot-high (60 m) pyramid temple of the Sun God Huitzilopochtli and Rain God Tlaloc lay at the heart of the Aztec capital, Tenochtitlán, at the place where the city was first founded. So sacred was this location that ever-larger and more elaborate pyramids rose on the same spot (Moctezuma, 1988).

Many ancient societies valued ritual objects, such as masks, ceremonial axes, and other symbolic artifacts that were associated with ancestor worship. These ceremonial artifacts were sometimes buried with a dead priest or leader, as with Tutankhamun and with the lords of Sipán in Peru. It is easy enough to tell their age and association with a grave dug at a particular period. In other instances, ceremonial artifacts can be treasured for generations, displayed only on special occasions or kept in a special relic hut. By treasuring such objects, however, the owners can unwittingly distort the archaeological record. Fortunately, in most cases it is possible to identify instances of curation, or preservation, by the style of the artifacts. In Tutankhamun's tomb, Howard Carter found objects that had belonged to earlier pharaohs. Presumably, they had been placed in the tomb to fill in gaps in the royal inventory caused by the king's unexpected death (Reeves, 2007).

Deliberate and Accidental Destruction

The many other potential causes of human distortion of the archaeological record can include deliberate destruction of cemeteries, erasure of inscriptions from temples at royal command, or the ravages of warfare, both ancient and modern. Even more destructive are depredations by treasure hunters and antiquities dealers to satisfy the greed of museums and private collectors (Waxman, 2009). Governmental greed, "innovation," or perhaps carelessness, is also to blame at times. The great Indus Valley site of Harappa in modern Pakistan was devastated when British colonials used its 4,500-year-old bricks as ballast for the railway line between Lahore and Multan in the 1850s and 1860s (Lahiri, 2005). Likewise, the Chinese government has a thirty year lease to quarry for raw material in Afghanistan, a situation that will certainly lead to the destruction of many ancient sites, with particular fears levelled against the important Buddhist site of Mes Aynak (Lawler, 2011).

Preservation Conditions: Inorganic and Organic Materials

Let us now examine preservation conditions, some of the circumstances under which the archaeological record comes down to us in exceptional condition. Under highly favorable circumstances, many kinds of artifacts survive, including such perishable items as leather containers, baskets, wooden arrowheads, and furniture. But under normal circumstances, only the most durable artifacts survive. In general, the objects found in archaeological sites are of two broad categories: inorganic and organic materials.

Inorganic materials include stone, metals, and clay. Prehistoric stone implements, such as the choppers made by early humans 2.5 million years ago, have survived in perfect condition for archaeologists to find. Their cutting edges are just as sharp as they were when abandoned by their makers. Clay pots are among the most durable artifacts, especially if they were well fired. It is no coincidence that much of prehistory is reconstructed from chronological sequences of changing pottery styles. Fragments (potsherds) of well-fired clay vessels are practically indestructible; they have lasted over 12,000 years in some Japanese sites.

Organic materials are objects made of plant- or animal-derived substances, such as wood, leather, bone, or cotton. They rarely survive in the ancient archaeological record. When they do, the picture of ancient life they give us is much more complete than that from inorganic finds.

Organic Materials and the Archaeological Record

Most of the world's ancient archaeological sites preserve little more than the inorganic remains of the past. Sometimes, however, especially favorable preservation conditions result in the survival of highly informative organic materials. Conditions of moisture and temperature extremes have preserved many archaeological sites.

Waterlogged Environs and Wetlands

Waterlogged or peat-bog conditions are particularly favorable for

preserving wood or vegetal remains, whether the climate is subtropical or temperate. Tropical rain forests, such as those of the Amazon basin and the Congo, are far from kind to wooden artifacts. In contrast, a significant number of archaeological sites occur near springs or in marshes where the water table is high and perennial waterlogging of occupation layers has occurred since they were abandoned (Coles and Coles, 1989; Bernick, 1998). Numerous shipwrecks have yielded valuable archives of information, for conditions underwater have preserved even insignificant artifacts. English King Henry VIII's warship *Mary Rose* yielded priceless information on Tudor ship construction and gunnery, as well as the skeletons of archers, their weaponry, and various day-to-day artifacts, large and small (Childs and Wales, 2007). The Uluburun Bronze Age ship from southern Turkish waters provided a unique portrait of eastern Mediterranean trade more than 3,300 years ago, and the ship's timbers add much to our knowledge of early marine architecture (see [Figure 1.7](#) on page 15 and [Chapter 16](#)).

Wetlands—dreary, waterlogged countryside such as found at Must Farm (see the Doing Archaeology box)—often strike us as far from appealing. In ancient times, wetlands came in an infinite variety, each type formed by unique depositional processes, and encompass a highly varied archaeological content. Many wetland sites have been well protected from the ravages of animal and human scavengers, and from the severe noncultural processes that act on more exposed locations. In some cases, as in the Somerset Levels of southwestern England, archaeologists have been able to reconstruct entire landscapes traversed by wooden walkways; their reconstruction methods have included not only walking but also use of aerial photographs, remote sensing, and subsurface boring. Next, we take a closer look at the Somerset Levels plus two further waterlogged sites that have been particularly illuminating.

Somerset Levels, England The Somerset Levels in England were once a bay of the nearby Severn River, filled with thick peat deposits between 6,000 and 1,500 years ago (Coles and Coles, 1986). As the lowest and wettest area in Britain, small parts still lie below sea level and large parts are regularly covered by flood waters, which has created something of a “closed environment” (Coles and Coles, 1989). This has

allowed archaeologists unparalleled insights onto the area's evolution from prehistoric times; through to the Romano—British era—including the 1998 metal-detectorist's discovery of the Shapwick Hoard, consisting of 9,238 silver Roman coins—one of the largest of its type ever discovered (see [Chapter 8](#) for more on metal detecting); and into the Medieval period and beyond (Gerrard and Aston, 2007)

Conditions on the Somerset Levels fluctuated constantly, and one of the most interesting archaeological projects in the area has been Coles and Coles's long-term excavations of wooden trackways that traversed people's traditional routes across the Somerset Levels (see [Figure 4.3](#)). Some 6,000 years ago, the Neolithic builders of the so-called Sweet Track needed a raised walkway to join two islands in a marsh.

They felled trees on dry ground, prepared them as required, and carried the wood to the marsh edge. Then they placed long poles end to end on the marsh surface along the preferred route. They usually used alder, ash, or hazel trunks pegged into the underlying wet ground with stout stems about every 3 feet (1 m). The pegs were driven in obliquely in pairs, crossing over the poles in a V shape. The builders then lodged planks into these crossed pegs on top of the poles, forming a mile-long walkway about 16 inches (41 cm) wide and about the same height above the poles.

The Sweet Track excavations have provided a unique opportunity for paleoenvironmental reconstruction and also for tree-ring analyses. A chronology from the ash trees has established that all the timber for the track was expertly felled at one time, with the track being used for about ten years. So detailed were the investigations that the excavators were able to show that part of the track, over a particularly wet portion, was repaired several times. Wooden wedges, wooden mallets, and stone axes were used for splitting the planks; other artifacts came from the crevices of the track, among them stone arrowheads, complete with traces of shaft, glue, and binding; hazel wood bows; and imported stone axes.

Tollund Man Bog Site, Denmark Peaty bogs and wet moorlands throughout Northern Europe sometimes contain extremely well-preserved ancient remains. Of these, the Danish bogs have yielded a particularly rich harvest of wood-hafted weapons, clothing, ornaments,

traps, and even complete corpses, such as that of Tollund Man (Glob, 2004). The individual's body was found by two peat cutters in 1950, lying on his side in a brown peat bed in a crouched position, a serene expression on his face, and eyes tightly closed (see [Figure 4.4](#)). Tollund Man wore a pointed skin cap and a hide belt—nothing else. We know that he had been hanged, because a cord was found knotted tightly around his neck. The Tollund corpse has been shown to be about 2,000 years old and to belong to the Danish Iron Age. A formidable team of medical experts examined the cadaver, among them a paleobotanist who established that Tollund Man's last meal consisted of a gruel made from barley, linseed, and several wild grasses and weeds, eaten 12 to 24 hours before his death. The reason for his execution or sacrifice is unknown.

[Figure 4.3 Reconstruction of a wetland pathway.](#)

Source: Courtesy of MS Bretherton/Alamy Stock Photo.

[Figure 4.4 Tollund Man, preserved for 2,000 years in a Danish bog.](#)

Source: robertharding/Alamy Stock Photo.

Ozette, Washington Richard Daugherty of Washington State University worked at the Ozette site on the Olympic Peninsula in the Pacific Northwest for more than a decade (Kirk, 1974). The site first came to his attention in 1947 as part of a survey of coastal settlements. Ozette had been occupied by Makah Indians until 20 or 30 years before, and traces of their collapsed houses could be seen on top of a large midden. It was not until 1966 that Daugherty was able to start excavations at the site, which was being threatened with obliteration by wave action and mudslides. A trial trench revealed large deposits of whale bones and yielded radiocarbon samples dating back 2,500 years. Most important, the muddy deposits had preserved traces of wooden houses and the organic remains in them. Then, in 1970, a call from the Makah Tribal Council alerted Daugherty to a new discovery. High waves had cut into the midden and had caused the wet soil to slump, revealing collapsed wooden houses buried under an ancient landslide.

[Figure 4.5 Ozette, Washington: Excavation of the walls, sleeping benches, and](#)

planks of a prehistoric house collapsed by a mudslide. The waterlogged conditions preserved wood and fiber perfectly.

Source: Courtesy of Library of Congress.

Daugherty and his colleagues worked for more than ten years to uncover the remains of four cedarwood longhouses and their contents. The excavations were fraught with difficulty. High-pressure hoses and sprays were needed to clear the mud away from the delicate woodwork. All the finds were then preserved with chemicals before final analysis. The wet muck that mantled the houses had engulfed them suddenly in a dense, damp blanket that preserved everything except flesh, feathers, and skins. The houses were perfectly preserved; one, uncovered in 1972, measured 69 feet long and 46 feet wide (21 m by 14 m). There were separate hearths and cooking platforms, and hanging mats and low walls served as partitions. More than 40,000 artifacts came from the excavations, including conical rain hats made of spruce roots, baskets, wooden bowls still impregnated with seal oil, mats, fishhooks, harpoons, combs, bows and arrows, even fragments of looms, and ferns and cedar leaves. The finds included a whale fin carved of red cedar and inlaid with 700 sea otter teeth (Figure 4.5).

The Ozette site is a classic example of how much can be recovered from an archaeological site in waterlogged conditions. But Ozette is important in other ways, too, for the Makah Indians who lived there had a tangible history extending back at least 2,000 years before the Europeans arrived. Oral traditions and written records for the Makah go back no farther than A.D. 1800. The Makah abandoned Ozette only in modern times, to move nearer to a school in the 1920s. The archaeological excavations have traced the continuity of this village of whale catchers and fisherfolk far back into the past, giving a new sense of historical identity to the Makah of today.

Dry Conditions

Very arid environments, such as those of the American Southwest or the Nile Valley, are even better for preservation than waterlogged localities. The caves of the arid North American Great Basin have preserved such organic finds as moccasins (see Figure 4.6). There now

follows two classic examples of sites that have been well preserved thanks to their dry conditions.

Figure 4.6 Patched deerskin moccasins from A.D. 500 from Hogup Cave, Utah.

Source: Courtesy of Werner Forman/Universal Images Group/Getty Images.

The Tomb of Tutankhamun, Egypt One of the most famous of all archaeological discoveries is the amazing tomb of Tutankhamun (circa 1323 B.C.), unearthed by Lord Carnarvon and Howard Carter in 1922 (Carter et al., 1923–1933; Reeves, 2007). The undisturbed burial chamber was opened, revealing the grave furniture in exactly the same state as it had been laid out by the king’s mourners. Gilded wood chests, cloth, ivory caskets, models of chariots and boats, and the mummy were all perfectly preserved, together with a bewildering array of jewelry and paintings shining as brightly as the day they were painted, even showing the somewhat hasty execution accorded to them by the artist. Tutankhamun’s sepulcher provides as vivid a glimpse of the past as we are ever likely to obtain (see [Figure 4.7](#)).

Chinchorro Mummies, Chile The Chinchorro culture flourished along the southern Peruvian and Chilean coasts of South America at least as early as 7000 B.C. The Chinchorro were a hunter-gatherer society that subsisted off the rich Pacific inshore fisheries and local patches of wild plant foods (Arriaza, 1995). They settled in permanent villages, burying their dead in cemeteries such as one at the El Morro site near Arica. More than 280 Chinchorro mummies have been recovered from coastal cemeteries, astonishingly well preserved in one of the driest environments on the earth. Beginning in about 5000 B.C. , the people dismembered the dead, skinned and eviscerated them, then packed the bodies with plant material and reinforced them with sticks. Then they sewed them together with human hair and cactus needles. With red-painted ash paste, they attached wigs of human hair, like helmets, to the skulls, and often painted the faces of the mummies black. Sometimes the mourners reattached the skin like bandages around the trunks and legs. The mummified bodies were displayed and cared for, then eventually wrapped in shrouds of twined reeds and buried in shallow graves, sometimes in family groups of six or more. Mummification

ceased among the Chinchorro in about 1500 B.C. , centuries before Tutankhamun ruled Egypt. The bone chemistry and bowels of the Chinchorro mummies reveal a diet heavy in seafood, evidence of tapeworm infestations, and auditory exostosis caused by diving in deep water.

Figure 4.7 Egyptian Dynasty XVIII, Thebes: Valley of the Kings, Tomb of Tutankhamun. The jumble of well-preserved artifacts, including chariots, funerary beds, and personal effects, in the south-end antechamber of Tutankhamun's tomb.

Source: Courtesy of Heritage Image Partnership Ltd/Alamy Stock Photo.

People of the Past Pharaoh Rameses II, 1212 B.C

Some of history's most celebrated people were larger-than-life personalities, or at least liked to pretend that they were. Warrior, administrator, and consummate propagandist, the Egyptian pharaoh Rameses II (1304–1212 B.C.), often called Rameses the Great, was one of these people. Rameses ascended the throne of ancient Egypt at age 25 and reigned for 67 years (Clayton, 1994). His father, Seti I, was an expert soldier, so the young prince participated in military campaigns in Libya and Syria at a young age. We learn from temple inscriptions at Abydos that he oversaw many of his father's grandiose building projects. He married his two principal wives, Nefertari and Isetnofret, while in his teens, and had at least seven children by them. During the course of his long life, Rameses sired more than 100 sons and numerous, uncounted daughters. He maintained a cosmopolitan harem that included Hittite princesses, who were diplomatic wives.

During the fifth year of his reign (1275 B.C.), Rameses had to mobilize his army for a campaign against the rival Hittites in present-day Syria. Near the city of Kadesh, he fielded 20,000 men against an even larger Hittite force that included 2,500 chariots. The charioteers swept through the Egyptian infantry, leaving Rameses abandoned by all except his bodyguards. The young pharaoh rallied his forces and, with the aid of a force of his elite soldiers, caused the Hittites to retreat. The battle resumed the next day but was a stalemate. Rameses, however, boasted of his bravery and of a great victory, which he commemorated in

bombastic inscriptions on the walls of the temples of the Sun God Amun at Karnak, Luxor, Abydos, and elsewhere. He was a king who ruled on a grandiose scale, who saw himself as a larger-than-life leader. The Hittite campaigns fizzled out and ended in a nonaggression pact finalized in 1259.

Archaeologists are only too familiar with Rameses, for he was the preeminent monument builder of all Egyptian kings. The king had no hesitation in adding hieroglyphic **cartouches** proclaiming his throne name, *User-moot-re*, “the Justice of Re is strong,” to temples and monuments built by his predecessors. He added to the great temples at Karnak and Luxor, completed his father Seti’s mortuary temple across the river, and built two imposing temples at Abydos. At least 3,000 workers quarried stone for his own giant mortuary temple, the Ramesseum, which rose on the west bank of the Nile opposite what is now Luxor. But his greatest architectural achievement lay far upstream at Abu Simbel, above the Nile’s First Cataract in Nubia, the desert territory known to the Egyptians as the “land of the bowmen.” (Many of Egypt’s mercenaries were Nubian bowmen.) Here Rameses constructed two temples out of a mountainside in 1255–1256. Four colossal (60 ft, 18 m) seated figures of the king front the Great Temple, flanking the entrance in pairs. The orientation of the entrance is so exact that the rising sun at the equinox on February 22 and October 22 shines through the entrance and illuminates three seated statues of gods in the interior.

Figure 4.1a The Battle of Kadesh, Syria. Rameses II riding into battle against the Hittites, a relief from Abu Simbel.

Source: Courtesy of PRISMA ARCHIVO/Alamy Stock Photo.

Figure 4.1b Rameses II, wearing his royal crown, triumphs over the enemy at Kadesh.

Source: Courtesy of PRISMA ARCHIVO/Alamy Stock Photo.

Figure 4.1c A portrait of Rameses II from the Temple of Amun, the Sun God, Luxor.

Source: Courtesy of [nagelestock.com/Alamy](https://www.nagelestock.com/) Stock Photo.

Egypt was enormously wealthy during the reign of Rameses the Great. He paid for his grandiose building projects with gold mined in the eastern desert or acquired as tribute. Much of this wealth went into constructing a new city in Lower Egypt's river delta, where Piramesse became a wealthy trading center adorned with fine temples and great obelisks. Almost nothing of Piramesse survives today.

Rameses ruled Egypt for so long that he outlived many of his children. He died at the age of 92 and was buried in the Valley of the Kings, burial place of all New Kingdom pharaohs. His tomb rivaled the magnificent edifice of his father and must have contained fabulous treasure. But it was looted within a few centuries and only a few artifacts survive. By good fortune, Rameses's mummy survived the robbers, for it was moved from his tomb to that of his father in 1054 B.C. and then hidden in a magnificent cache of royal mummies that came to light in 1881. In 1976, the mummy was flown to Paris for a grand exhibition, then examined by experts using the latest medical technology. The king was 5 feet 8 inches (1.7 m) tall and still possessed his fine aquiline nose, which the embalmers had stuffed full of peppercorns in order to maintain its shape. He suffered from arthritis, painful dental abscesses, and poor circulation, none of which is surprising given his advanced age. Scientists today know more about the pharaoh's health than he ever did.

Figure 4.1d Four colossal seated figures of the king form the façade of the Great Temple at Abu Simbel.

Source: Courtesy of Michele Burgess/Alamy Stock Photo.

As befitted a great pharaoh, Rameses II arrived at the Paris airport with a full presidential guard of honor. And today he resides, once more, in the Cairo Museum.

Figure 4.1e The mummy of the pharaoh Rameses II.

Source: Courtesy of MARKA/Alamy Stock Photo.

Extreme Cold Conditions

Arctic sites, too, are excellent for preserving the human past. The circumpolar regions of Siberia and the Americas have acted like a giant

freezer in which the processes of decay have been held in check for thousands of years. Close to the Arctic Ocean, dozens of deep-frozen mammoth carcasses have survived for millennia in a state of perennial refrigeration. Perhaps the most famous is the Beresovka mammoth, which became mired on the swampy banks of a Siberian river one spring some 10,000 years ago. The Russian expedition that recovered the carcass in 1901 found the meat so fresh that the scientists fed it to their dogs. The mammoth's hair was perfectly preserved, and the remains of its last meal were found on its tongue and in its stomach.

In some cases, the archaeology is being revealed as a result of rising global temperatures (with a predicted increase of around 2°C by the end of this century according to the Intergovernmental Panel on Climate Change). As a result of this thawing, tens of thousands of “new” archaeological sites have already been identified in the North American Arctic, though only a small number have been excavated. In a “race against time,” institutes such as the Arctic Institute of North America are currently using far quicker recording methods, notably wide-scale three-dimensional LiDAR laser-scanning (see [Chapter 8](#)), to document as many of the “at-risk” sites as possible (Millar, 2016). Let's now explore the findings from four extremely cold sites from across the world.

Figure 4.8 A reconstruction of “Ötzi the Ice Man” from the Similaun glacier in the European Alps.

Source: Courtesy of MARKA/Alamy Stock Photo.

“Ötzi the Ice Man,” Italian Alps A combination of dry winds and extreme cold dried out and preserved a 5,300-year-old Bronze Age corpse found near the Similaun glacier, in the Ötztal Alps of South Tyrol in 1991 (Spindler, 1994) (see [Figure 4.8](#)). The 40-year-old man's body was first dried out by cold winds, then buried by snow and ice before being exposed in modern times when the glacier melted in warm weather. The man carried a copper ax with a wooden shaft, a leather quiver with 14 bone- and wood-pointed arrows, and replacement arrowheads and a puttylike substance for mounting them. He wore leather boots lined with hay for warmth, a stone necklace, and leather and fur garments. His knee and back bore small tattoos. State-of-the-art

medical scanners show that death resulted from an arrow wound under his left collarbone, which tore a hole in an artery. He went into shock and died from a heart attack, collapsing in the small gully where he was found (Pernter et al., 2007). Amid great scientific excitement, researchers have already retrieved the first complete mitochondrial-genome sequence of a prehistoric European (or the DNA inherited from one's mother, see [Chapter 16](#)). The Similaun body has been radiocarbon-dated to between 3350 and 3300 B.C. , making this the oldest surviving European corpse. For more on the Ice Man, turn to [Chapter 16](#).

Inca Mountain Sacrifices, Peru and Argentina The Inca people of South America carried out human sacrifices on mountain peaks high in the Andes, for they regarded such mountains as sacred. Fortunately for science, the bitterly cold conditions at high altitude preserved the mummies of young boys and girls in near-perfect conditions. Anthropologist Johan Reinhard (2006) and his Peruvian colleague Miguel Zarate found the mummy bundle of a girl at an altitude of 20,700 feet (6,210 m) in the southern Peruvian Andes. The 14-year-old Inca girl died as a sacrificial victim five centuries ago and was buried on a summit ridge of the sacred Nevado Ampato mountain (see [Figure 4.9](#)). Her well-preserved body was wrapped in a rough outer garment over a brown-and-white-striped cloth. Underneath, she wore a finely woven dress and a shawl fastened with a silver pin. Her feet bore leather moccasins, but her head was bare. She may originally have worn a fanlike feather headdress, which was dislodged when the summit ridge collapsed and her mummy bundle fell down a slope. Computerized tomography (CT) scans of her skull revealed fractures by her right eye. She died from a massive hemorrhage resulting from a swift blow to the head. Blood from the wound pushed her brain to one side of her skull.

Figure 4.9 The Nevado Ampato mummy, Peru.

Source: Courtesy of National Geographic Image Collection.

Reinhard (2006) later discovered three more mummies—two girls and a boy—in the Argentinean Andes in such good condition that their

organs were intact. The researchers could even see the fine hair growing on the victims' arms. Frozen blood may still fill the heart of one mummy. The children were between 8 and 14 years old when they died, but their cause of death has not yet been established. The clothed victims were buried with a rich collection of three dozen gold, silver, and shell ritual figures, half of them clothed. Bundles of ornate textiles, moccasins, and clay vessels, some even containing food, accompanied the children. These were remote sacrifices, lying at the summit of a volcano at least 124 miles (200 km) from the nearest village.

Tragedy at Utqiagvik, Alaska Another spectacular discovery, this time on a bluff overlooking the Arctic Ocean near Barrow, Alaska, also records a tragedy, this one from more recent times. Two Inupiat women, one in her forties, the other in her twenties, were asleep in a small driftwood-and-sod house on a bluff overlooking the ocean on a stormy night in the 1540s (Hall et al., 1990). A teenage boy and two young girls slept nearby. The sea ice was crashing against the shore, the ice pack driven against the coast by high waves. Suddenly, a giant mass of ice chunks broke free in a violent surge and was carried over the bluff, crashing tons of ice down on the tiny house. The roof collapsed, killing the inhabitants immediately. At dawn, the neighbors found the house silent and left it buried under the ice. Later, members of the family removed some utensils and food from the ruins, and the timber uprights projecting through the ice were salvaged. The rest was undisturbed for four centuries, a deep-frozen prehistoric tragedy.

Five centuries ago, Utqiagvik was a large settlement (there are at least 60 house mounds), but it is now buried under much of an expanding Barrow, Alaska. In 1982, the remains of the winter house of the two Inupiat women came to light, intact and still mostly frozen. The house was formed of hand-hewn driftwood used for both floorboards and wall panels. Everything was held together with a matrix of frozen earth, and the house was insulated with a sod roof. The well-preserved bodies of the women were autopsied. Both had been in reasonably good health, although their lungs were blackened with anthracosis, a condition caused by inhaling smoke and oil-lamp fumes in closed-in winter houses. They ate a heavy diet of whale and seal blubber, which had narrowed their arteries and caused atherosclerosis. The older

woman had given birth about two months before the disaster and was still lactating. Both of them had suffered periods of poor nutrition and illness. The older had recovered from pneumonia and a painful muscle infection called trichinosis, perhaps contracted from eating raw polar bear meat. The women had slept naked under their bed robes, probably to avoid moisture buildup in their everyday garments, which would freeze when they went outside.

Outside, they had worn caribou parkas, snow goggles, mittens, and waterproof sealskin inner boots, all found in the entrance tunnel to the house. Much of their time was spent making and repairing clothing and maintaining the hunting gear that was well preserved in the ruins. There were bone harpoon heads for hunting seals and other sea mammals, with the remains of a bola, a sinew throwing device weighted with bone used to snare birds in flight. A wooden bucket stitched together with baleen and a wood-and-bone pick for clearing ice were recovered near the house entry.

Volcanic Ash

Most people have heard of Roman Herculaneum and Pompeii, entire towns overwhelmed in A.D. 79 by an eruption of nearby Vesuvius. The volcanic ash and lava buried both communities, even preserving the body casts of fleeing victims (see [Figure 2.1](#) on page 28). Such sites are rare, but when they are discovered they yield remarkable finds. In about A.D. 580, a volcanic eruption in El Salvador suddenly buried a small Maya village at Cerén (Sheets, 2002). The people had eaten their evening meal but had not yet gone to bed. They abandoned their houses and possessions and fled for their lives. Not only did the ash bury the village, but it also smothered the nearby crops, burying corn and agave plants in the fields. Payson Sheets and a multidisciplinary research team have recovered entire dwellings and outhouses and the artifacts within them just as they were abandoned, for the ash was too thick for the people to rescue their possessions.

Each Cerén household had a building for eating, sleeping, and other activities, as well as a storehouse, a kitchen, and sometimes other structures (see [Figure 4.10](#)). Substantial thatched roofs projected beyond the walls, providing not only covered walkways but also places for

processing grain and for storage. Each household planted maize, cacao, agave, cassava, and other crops in gardens close to the house, setting most crops in neat rows. Grain was stored in clay vessels with tight lids. Some corn and chilies were suspended from the roof, and many implements were also kept in the rafters. So far, the excavations have uncovered three public buildings, one of which may have been a community center. Also found were outlying maize fields, where the plants were doubled over, with the ears still attached to the stalk—a “storage” technique still used in parts of Central America. The mature maize plants indicate that the eruption occurred at the end of the growing season, in August.

Figure 4.10 Cerén, El Salvador. Excavations through volcanic ash revealed an abandoned Maya village of about A.D. 580.

Source: Courtesy of Dennis Cox/Alamy Stock Photo.

Cerén provides an unusually complete look at life in a humble Maya settlement far removed from the great ceremonial centers where the elite lived. It is remarkable for its complete artifact inventories and food supplies, finds so well preserved that even minute details of village architecture are evident. We even know where the Cerén people kept their sharp knives away from curious children—in the rafters of their houses.

Contemporary Sites

When does the present become the past, and at what point does the past become archaeology? In a new turn of events, archaeologists have recently begun to study sites that have only just been abandoned. Depending on their precise age, they can have an extremely good—if not perfect—level of preservation.

Such was the case when a team arrived at the London studio of the modern artist Francis Bacon. After his death in 1992, archaeologists and conservators conducted a meticulous survey and excavation of his studio in order to transport it to Ireland, Bacon’s birthplace, where it has since been faithfully reconstructed in the Dublin City Gallery. Close examination of his studio, and the 7,500 items found therein, including photographs, slashed canvases, and handwritten notes, has

revealed new insights on the complex psyche of Bacon (Cappock, 2005).

Even yesterday's rubbish has been explored by archaeologists (specifically known as "garbologists")—such as the Garbage Project, set up by William Rathje (see [Chapter 19](#)). His systematic investigations into the garbage accumulated in different areas of the Arizonan city of Tucson, which allowed explorations into the patterns of modern consumption (Rathje and Murphy, 1992).

At the other end of this spectrum, forensic archaeologists are increasingly being employed on modern battlefield sites, including in Bosnia and West Africa (see [Chapter 16](#)). Their results have been used in the investigation of war crimes and allied atrocities (Renfrew and Bahn, 2016).

Summary

1. Site formation, or transformational, processes are factors that create the historical and archaeological records, natural or cultural agencies that have changed the archaeological record during and since a site was abandoned.
2. There are two basic types of site formation processes. Cultural transformations are those in which human behavior has changed the archaeological record through such acts as rebuilding houses or reusing artifacts. Noncultural processes are events and processes of the natural environment that affect the archaeological record, such as the chemical properties of the soil and natural phenomena such as earthquakes and wind action.
3. Later human activity can radically affect archaeological preservation. People may selectively discard or preserve some types of artifacts, and many variables can affect the layout of settlements and other considerations. Some people, such as the Southwestern Indians, recycled wooden beams and other materials, distorting the archaeological record. Sites are reused, lower strata are often disturbed, and succeeding generations may preserve an important building, such as a temple, for centuries. Modern warfare, industrial activity, even deep agriculture and cattle grazing can affect the preservation of archaeological

remains.

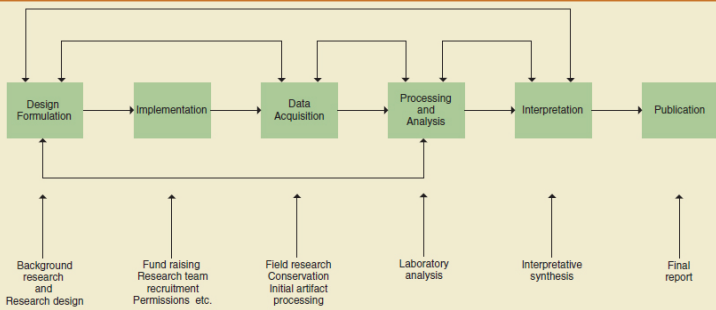
4. Preservation conditions depend mostly on the soil and general climatic regime in the area of a site. Inorganic objects, such as stone and baked clay, often survive almost indefinitely. But over long periods, organic materials, such as bone, wood, and leather, survive only under exceptional conditions, such as in dry climates, permafrost, and waterlogged areas.
5. Waterlogged and peat-bog conditions are especially favorable for preserving wood and vegetal remains. In this context, the Somerset Levels, Danish bog corpses, and the Ozette village in Washington State were discussed as sites of these types.
6. Dry conditions can preserve almost the full range of human artifacts, the best examples being the remarkably complete preservation of ancient Egyptian culture and the finds made in desert caves in the American West and in South America.
7. Arctic conditions can refrigerate organic materials in the soil. The discovery of the “Ice Man” in the European Alps as well as Inca mountain sacrifices in South America, a buried Eskimo family in Alaska, were described.
8. Volcanic ash preserved the Maya village at Cerén in El Salvador. A sudden eruption mantled the settlement in thick ash, so that entire houses and their contents, as well as gardens, survived intact.
9. Modern sites tend to possess excellent levels of preservation simply by virtue of their young age. However, these, too—such as the studio of artist Francis Bacon—can be investigated using archaeological methods.

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5

Doing Archaeological Research

CHAPTER OUTLINE

The Archaeologist's Skills

Archaeology and Science

The Process of Archaeological Research

Moai statue on the north coast of Rapa Nui (Easter Island) in the South Pacific. These ancestral figures once bore topknots of red volcanic rock.

Source: Courtesy of MJ Photography/Alamy Stock Photo.

One of the most essential qualities of an archaeologist is an ability to function as a member of a team. A century ago, most archaeologists worked virtually alone. Today, archaeologists work much more carefully and never alone. They collaborate not only with other archaeologists but also with scientists from other disciplines. All archaeological research is a complex process involving research design, field surveys, excavation, and lengthy laboratory analyses of many types of finds.

After discussing the qualifications of a good archaeologist, this chapter looks at the relationship between science and archaeology and at inductive and deductive reasoning. Then we describe the process of archaeological research itself. This chapter is an important preliminary to later discussions of archaeological data acquisition.

The Archaeologist's Skills

Today's archaeologists need specialist training in administrative, technical, and academic skills of many types (Carver, 2009). Modern archaeology has become so complex that few individuals can master all the skills needed to excavate a large city or even a medium-sized settlement where preservation conditions are exceptionally complete. In the 1920s, Leonard Woolley excavated Ur in southern Iraq with a handful of Europeans, three expert Syrian foremen, and several hundred workers. The archaeologists who excavated the Anglo-Saxon ship burial at Sutton Hoo, England, before World War II worked almost alone, with little expert assistance (see the following Discovery box). Recent, meticulous excavations involved a carefully organized team of experts whose skills reflected the complexity and environmental setting of the site (Carver, 2005). Furthermore, as stewards of a fragile resource, we have an obligation to preserve the past for the future, to acquire the maximum amount of information for the minimal disturbance of the resource. Let us examine, then, some of the basic skills that an archaeologist needs.

Theoretical Skills

The archaeologist must be able to define research problems in their context—everything that is known about them. This knowledge includes the current status of research on a specific problem, such as the origins of humanity or the earliest human settlement of Ohio, and the latest theoretical and methodological advances in archaeology that could affect the definition and solution of the problem. The research problem will be defined by the specific objectives to be achieved. The archaeologist must have the expertise to formulate the precise hypotheses to be tested in the research. As the research proceeds, he or she has to be able to evaluate and put together the results of the work in the context set by the original objectives.

Methodological Expertise

Every archaeologist must have the ability to plan the methods to be used in the research to achieve the theoretical goals initially laid out (Carver, 2009; Hester et al., 2008). Methodological skills include being able to select among methods of data collection and to decide which analytical methods are most effective for the data being handled. Excavating sites and conducting field surveys require a large range of methodological skills, from deciding which sampling or trenching systems to use, to devising recording methods, to dealing with special preservation conditions in which fragile objects have to be removed intact from their matrix.

One important aspect of methodological expertise requires selecting and working with specialists from other disciplines. Teamwork between experts is especially important on cultural resource management (CRM) projects, for which teamwork is a daily reality and schedules for completing field and laboratory research are often tight. Every team member needs to understand multidisciplinary research and must know the uses and limitations of the work done by, say, geologists or zoologists, for the specific problems being investigated.

Technical Skills

Methodological and technical skills overlap, especially in the field. The scientific excavation of any site or a large-scale field survey requires

more than the ability to select a method or a recording system; one also needs to execute it under working conditions. Archaeological excavations require great precision in measurement and excavation, deployment of skilled and unskilled labor, and implementation of find-recovery systems that keep artifacts in order from the moment they are found until they are shipped to the laboratory for analysis. At issue here is the provenance of the artifacts and the features of the associated **ecofacts**—nonartifactual materials, such as food residues and other finds that shed light on human activities. The field archaeologist has to assume the roles of supervisor, photographer, surveyor, digger, recorder, writer, and soil scientist and must be able to deal with any unexpected jobs, such as uncovering the delicate bones of a skeleton or setting up the details of a computer program. On large sites, expertly trained students or fellow archaeologists may assume such specialist tasks as photography; on small sites, the archaeologist must often perform this and all other tasks single-handedly.

DISCOVERY A Saxon Ship Burial at Sutton Hoo, England, 1939

In 1939, when British archaeologist Basil Brown asked landowner Elizabeth Pretty which of the burial mounds on her property at Sutton Hoo in eastern England she wanted opened, she pointed to the largest and asked, “What about this?” Her casual choice epitomized the archaeology of 60 years ago but led to a remarkable feat of archaeological excavation.

The work began that very afternoon with the cutting of a wide trench across the mound. Brown soon found five iron ship nails and suspected at once that he had found a funerary boat. With trowels and brushes, he and his workers cleared the bow and eleven frames of an Anglo-Saxon vessel. When he reached a sealed bulkhead, Brown wisely stopped the excavation and called in Charles Phillips of Cambridge University, an expert on Anglo-Saxon sites and on ancient timber structures. Phillips was a meticulous excavator. He followed gray discolorations in mound soil and traced the lines of the boat and the planked burial chamber that lay amidships (see [Figure 5.1](#)). The diggers even found evidence of repairs to the hull. With infinite care, they

opened the burial chamber, recording and conserving each find, however small. The chamber contained the treasure buried with a long-vanished body of a nobleman, which included metal cauldrons, bowls, spears, axes, bottles, and 37 coins dating to about A.D. 650. The boat was one of two in the burial mound. It was 89 feet (27 m) long; it had no mast or sails and was propelled by 38 oars, and it had been dragged overland 0.3 miles (0.5 km) to its final resting place.

Figure 5.1 The Sutton Hoo ship exposed by excavating gray discolorations and iron nail fragments in the soil.

Source: Courtesy of Associated Newspapers/REX/Shutterstock.

Administrative and Managerial Skills

Modern archaeology, whether academic research or CRM, requires that its practitioners exercise high-level administrative and managerial skills. Today's archaeologist has to be able to coordinate the activities of specialists from other disciplines, organize and deploy teams of volunteer students and paid laborers, and raise and administer research funds obtained from outside sources. He or she must always be aware of all aspects of a research project as it progresses, from arranging for permits and supplies of stationery and digging tools to keeping the accounts. CRM archaeologists have to be able to negotiate and carry out project contracts and ensure compliance with legal requirements (see [Chapter 18](#)).

Above all, anyone working on an archaeological project has to be an expert in human relations—keeping people happy at demanding work that is often carried out under difficult and uncomfortable conditions. The diplomatic side of archaeological excavations is often neglected. But the folklore of archaeology abounds with stories of disastrous excavations run by archaeologists with no sensitivity toward their fellow workers. A truly happy excavation is a joy to work on, a dig on which people smile, argue ferociously over interpretations of stratigraphic profiles through an endless day, and enjoy the companionship of a campfire or a nearby bar in the evenings.

Writing and Analytical Skills

If there is one basic lesson to be learned at the beginning of any archaeological endeavor, it is that all excavation is destruction of finite archives in the ground that can never be restored to their original configuration. Every archaeologist is responsible not only for analyzing the finds in the laboratory but also for preparing a detailed report on the fieldwork that has been done—an important part of the permanent record of archaeological research. Regrettably, the shelves in museums the world over bulge with finds from sites that have been excavated but never written up. An unpublished site is effectively destroyed. Prompt publication is an ethical responsibility for all archaeologists.

At first glance, the list of qualifications a professional archaeologist needs can be formidable. In practice, though, sound classroom training combined with a great deal of fieldwork experience provide the necessary background.

Archaeology and Science

In various places this text has referred to scientific archaeology, the scientific method, and the testing of hypotheses against data collected in the field (Kelley and Hanan, 1988). What do we mean by “scientific”? **Science** is a way of acquiring knowledge and understanding about the parts of the natural world that can be measured. It is a disciplined and carefully ordered search for knowledge, carried out in a systematic manner. This is a far cry from the ways in which we acquire our personal experience of religious philosophies, social customs, or political trends. Science involves using methods of acquiring knowledge that are not only cumulative but also subject to continuous testing and retesting.

The Scientific Method

Over the years, scientists have developed general procedures for acquiring data, known as the **scientific method**, which have come into wide use. Even though the scientific method may be applied in somewhat different ways in botany, zoology, and anthropology, the basic principles are the same: the notion that our knowledge of the real world is both cumulative and subject to constant rechecking. The

scientific method has many applications to archaeological data, and its use classifies much of archaeology as a science. Science establishes facts about the natural world by observing objects, events, and phenomena. In making these observations, the scientist proceeds by using both inductive and deductive reasoning.

Inductive reasoning takes specific observations and makes a generalization from them. One of us (Brian Fagan) once found nearly 10,000 wild vegetable remains in a 4,000-year-old hunter-gatherer camp in central Zambia. More than 42 percent of them were from the bauhinia, a shrub currently prized for its fruit, roots, and flowers from October to February. The bauhinia is still eaten by San hunter-gatherers in the Kalahari. From these observations, he used the process of induction to hypothesize that bauhinia has been a preferred seasonal food for hunter-gatherers in that area for thousands of years (Fagan and Van Noten, 1971).

Deductive reasoning follows from hypotheses formulated through induction. That is, the researcher postulates specific implications from the generalized hypotheses. In the Kalahari, Brian Fagan would have formulated a hypothesis (or series of hypotheses) about bauhinia eating by San and prehistoric hunter-gatherers and then tested it with ethnographic fieldwork and archaeological investigations based on the specific implications of the hypothesis. Brian's hypothesis would then be confirmed, rejected, or refined.

A classic example of applying the scientific method comes from field studies done in the Great Basin in the western United States by anthropologist Julian Steward and the archaeologists who expanded on his work. Steward spent much of the 1920s and 1930s working on Shoshonean ethnography. The mass of field data he collected led him to formulate hypotheses about the ways in which the Shoshoneans moved their settlements throughout the year (Steward, 1938).

In the late 1960s, this pioneering work was greatly refined by David Hurst Thomas, who deduced densities and distributions of artifacts in the various ecological zones of the Great Basin from Steward's hypotheses about Shoshonean settlement patterns. "If the late prehistoric Shoshoneans behaved in the fashion suggested by Steward, how would the artifacts have fallen on the ground?" he asked (Thomas, 1983a, 1983b: 14). Thomas constructed more than 100 predictions

relating to Steward's original hypotheses and then devised tests to verify or invalidate his predictions. He expected to find specific forms of artifacts associated with particular types of activity, such as hunting, in seasonal archaeological sites where hunting was said to be important. Aware of local preservation conditions, he strongly emphasized the distribution and frequency of artifact forms. Then he collected the archaeological data from the field needed for his tests. Finally, Thomas tested each of his predictions against the field data and rejected about 25 percent of his original ones. The remainder were supported by the data and provided a major refinement of Steward's original hypotheses. Later fieldwork gave him abundant opportunities to refine these hypotheses and to collect more data to test them further. Thomas's Great Basin research is a good example of the benefits of the scientific method in archaeological research.

The importance of the scientific method, however, should not be overestimated. Science advances by disproof, proposing the most adequate explanations for the moment, knowing that new and better explanations will later be found. In this way, the scientific method self-corrects as research progresses.

Remarkably, there is almost no literature on how archaeologists come to their conclusions (Hodder, 1999) but clearly, archaeology, with its concerns with social and political structures and other human behavior, is not nearly as potentially empirical as, say, physics. The controlled progress from hypothesis to testing to conclusion associated with the scientific method simply does not work in much archaeology, where researchers spend a lot of time in the field fitting together different pieces of evidence, such as stratified layers and ruined dwellings. A great deal of archaeology is about physical relationships, whether between features and finds, layers and environmental data, and so on. It is also about using comparisons from other sites and modern data (**analogy**). Above all, though, it is about constructing narratives, which can involve everything from recording the layers in a trench wall to interpreting an entire site (Hodder and Evans, 1999).

The Process of Archaeological Research

We now describe the process of archaeological research from

formulation of the research design to publication of the final report. [Figure 5.2](#) illustrates the process.

Research Design and Formulation

A **research design**, simply defined as a working plan for a research project, whether simple or complex, is intended to direct the execution of an archaeological investigation. It has multiple objectives—to ensure that the results will be scientifically valid and to carry out the research as efficiently and economically as possible with minimal disturbance of the record (Binford, 1964). There are also issues of stewardship, of ensuring that the views of specialists in different disciplines and others with a stake in the sites are taken into consideration, as is the case with a well-known site like Stonehenge or the 9,000-year-old farming settlement at Çatalhöyük in Turkey (Hodder, 1999).

The process of archaeological research, then, is controlled by the research design, which takes the project through stages. These stages are by no means common to all research projects, for although “research design” sounds rigid and inflexible, in practice the design for any project has to be flexible enough to allow changes in the overall project as field research proceeds.

Any archaeological research begins with fundamental decisions about the problem or area to be studied. A research problem can be as grandiose as determining the origins of agriculture in the American Southwest—a truly enormous project—or as specific as determining the date of the second phase in Stonehenge’s construction or surveying a small lot in New York City. The initial decisions will identify both the problem and the geographic region in which it will be investigated. The latter can be one site or an entire region. These decisions immediately limit the scope of the research design.

[Figure 5.2 The process of archaeological research.](#)

Once the problem and the area have been identified, the researcher must do a great deal of background research, involving both library work and field investigations. He or she must read up on previous archaeological research on the problem and study the geology, climate, ecology, anthropology, and general background of the area. Several field

visits are essential, both to examine fieldwork conditions and to get a feel for the region. Water supplies, campsites, and sources of labor have to be identified. Landowners' permissions to dig and survey are essential, and government permits may be needed. At least some preliminary fieldwork is needed to aid in formulating the research design, especially in areas where no archaeology has been carried out before. This reconnaissance is really designed to see what is there and to evaluate the potential significance of the site or area. Does it offer an opportunity for providing new knowledge? What kinds of research will be needed to minimize impact on the sites involved? What conservation work will be needed, and will there be site management issues in the future?

The objective directing all this initial work is to refine the problem being investigated until the archaeologist can begin to define specific research goals. These goals will almost inevitably include testing fairly specific hypotheses, which can be related to research carried out by previous investigators or can be entirely new hypotheses that come out during the preliminary formulation of the research problem. More goals will be added as the research work proceeds. Generating hypotheses at this stage is vital, for they determine the types of data that will be sought in the field. The types must be defined, at least in general, before one goes into the field.

Let's take two hypotheses designed as part of a research project involving early food production in Egypt:

1. The earliest cereal agriculture near Kom Ombo developed among hunter-gatherers who had been exploiting wild vegetable foods very intensively.
2. The emergence of agriculture came about as a result of the intensification of gathering and rapid population growth that caused shortages of wild cereals, which led to people beginning to grow wild cereals for themselves.

What sorts of data would be needed to test these hypotheses at Kom Ombo? The archaeologist formulating the project of which this hypothesis is a part would be looking for the following:

- Sites in areas where wild cereals could have grown, where

preservation conditions would allow for survival of vegetal remains.

- Food residues in the form of carbonized and discarded vegetable foods and the bones of domesticated animals.
- Implements used for harvesting and processing both wild and domesticated grains—grindstones, sickles, and so on.
- Evidence for such features as storage pits or baskets, indicating deliberate conservation of food supplies.
- Sites that were occupied longer than the relatively short periods favored by most hunter-gatherers, since farmers have to watch over their crops.

Armed with both hypotheses and lists of the types of evidence likely to be encountered in the field, the archaeologist can plan for the equipment, facilities, and people needed to carry out the job. Even more important, the project can be formulated with advice from experts, whose specialist knowledge will be needed either in the field or in the laboratory. The necessary contacts with experts are best made before the fieldwork begins and funds are obtained. A surprising number of specialists are needed for even quite simple investigations. The Kom Ombo hypothesis could ideally require the long- or short-term services of the following experts:

- A geologist to assist in geological dating of sites in the Nile Valley.
- A soil scientist to study occupation levels and organic soils.
- A radiocarbon-dating expert to date carbon samples.
- A botanist to supervise recovery of vegetal remains and to identify them.
- An expert on pollen analysis to work on any such samples recovered in the excavations.
- A zoologist to study the animal bones.

Doing Archaeology Ancient Wine at Abydos, Egypt

Much of archaeological research combines excavation with high-technology laboratory analysis, which may radically change the

original interpretations of a site. In 1988, German Egyptologist Günter Dreyer excavated the tomb of one of Egypt's first leaders at Abydos on the Middle Nile. Pharaoh Scorpion I lived in about 3150 B.C. His elaborate tomb contained four rooms that were stocked with at least 700 jars that held a total of approximately 1,200 gallons (4,550 liters) of wine. Forty-seven of the jars contained wine pips, together with remains of sliced figs that had been suspended on strings in the wine, probably to sweeten it. The crusty residues adhering to the insides of the pots were analyzed with an infrared spectrometer and liquid chromatography, which revealed the remains of tartaric acids (found naturally in grapes) and of terebinth resin, which ancient vintners used to prevent wine from turning into vinegar. Neutron activation analysis of the clay jar yielded trace element clusters that were compared against a large database of samples from Egypt and the eastern Mediterranean. The database pointed to the southern hill country of Israel and Transjordan as the source of the vessels, an area where vine growing was well established in 3100 B.C. The wine probably traveled the Nile across an ancient trade route, "the Way of Horus," that linked southern Israel with Egypt via the Sinai Desert. By 3000 B.C., wine growing had been well established in the Nile Delta in northern Egypt, the source of the pharaoh Tutankhamun's wines 1,500 years later (McGovern, 2007, 2010) (Figure 5.3).

Figure 5.3 Ancient Egyptian wine production. Estate workers employed by a New Kingdom official of the fourteenth century B.C., Nahat Beni-Amon, gather the grapes and press them. Large wine jars used for stirring the wine are at center.

Source: Courtesy of www.BibleLandPictures.com/Alamy Stock Photo.

The larger-scale project may take an integrated team of experts from several disciplines into the field—an expensive enterprise that often yields important results. Robert Braidwood of the University of Chicago revolutionized the study of early agriculture in southwestern Asia during the 1950s when he took such a team of experts with him to the Zagros Mountains in Iran. The research team was able to trace agriculture and animal domestication from their beginnings among nomadic hunter-gatherers on the highlands more than 9,000 years ago

(Braidwood and Braidwood, 1983).

Research design has a critical role in cultural resource management (see [Chapter 18](#)). Regional research designs for large areas, such as the San Juan basin in Colorado provide a long-term framework for hundreds of small environmental impact studies and research projects. These designs are not cast in concrete; they are ever-changing documents that are updated regularly to accommodate changing methodologies and new circumstances in the field. In CRM projects, the research design often incorporates recommended courses of action to mitigate damage caused by construction work and other nonarchaeological activities.

The final stage in formulating an academic research project is acquiring the necessary funding. This can be frustrating and time consuming, for sources of money for archaeological fieldwork are always in short supply. Most purely academic excavations organized in the Americas are funded either by the National Science Foundation or, if within the United States, by some other government agency, such as the National Park Service. CRM contracts now provide most archaeological funding in North America and in many other countries. Some private organizations, such as the National Geographic Society and the Wenner Gren Foundation for Anthropological Research, support excavations. Many excavations, such as the regular seasons at Aphrodisias in Turkey or Crow Canyon in the U.S. Southwest, rely heavily on private donations. The organizers spend much time seeking private gifts to support each field season and the laboratory work that follows it.

Data Collection

Once the field team has been assembled and the funds are in hand, actual implementation of the project begins. The first stage is to acquire equipment, set up a base, and organize the research team in the field. Once that preparatory phase has been completed, collection of archaeological data can begin.

Data collection involves two basic processes: locating and surveying sites and scientifically excavating carefully selected sites. Locating archaeological sites is obviously the first stage in collecting data. As will

be discussed in [Chapter 8](#), reconnaissance can be carried out on foot, in vehicles, or even on the back of a mule. A variety of techniques are used to ensure that a representative sample of the sites is located and investigated before excavation. Then the surfaces of the sites are carefully examined, and samples of artifacts at ground level are collected to record as much as possible about the location without the expense of excavation. This recording can include photographs, some surveying and measurement, and often, especially on CRM projects, some probing of the site with borers or electronic devices (see [Chapter 8](#)). Obviously, much less information is collected from surface surveys than from excavations.

Archaeological excavations are ultimately a recording of subsurface features and the provenance—or precise spatial relationships—of the artifacts within the site. Various techniques are used to collect and record archaeological data from beneath the ground, and these techniques are described in [Chapter 9](#). The scope of archaeological excavation can range from a small test pit to a large-scale investigation at an ancient city.

[Data Processing, Analysis, and Interpretation](#)

The end products of even a month's excavation on a moderately productive site are a daunting accumulation. Box upon box of potsherds, stone tools, bones, and other finds are stacked in the field laboratory and must be cleaned, labeled, and sorted. Hundreds of digital images, slides, and photographs must be processed and cataloged. Computer records and rolls of drawings with information on the provenance of finds from the trenches must also be cataloged. Then there are radiocarbon and pollen samples, burials, and other special finds that need examination by specialists. The first stage in processing the data, then, occurs at the site, where the finds are washed, sorted, and given preservation treatment sufficient to transport them to the archaeological laboratory for more thorough examination.

The detailed and time-consuming laboratory analysis include not only classifying artifacts and identifying the materials from which they were made but also studying food remains, pollen samples, and other key sources of information. All these analyses are designed to provide

information for interpreting the archaeological record. Some tests, such as radiocarbon dating or pollen analysis, are carried out in laboratories with the necessary technical equipment. We describe various approaches to archaeological analysis in [Chapters 10 through 17](#).

Interpreting the resulting classified and thoroughly analyzed data involves not only synthesizing all the information from the investigation but also final examination of the basic questions formulated at the beginning of the project. These tests produce models for reconstructing and explaining the prehistory of the site or region, as illustrated by the Abydos investigation (see the Doing Archaeology box on page 176). The Doing Archaeology box on the Amesbury Archer (see page 85) is also an exemplary capsule of the process of archaeological research. We look at some of these models and interpretations in [Part VII](#).

Publication

“Publish or perish” goes the saying—and that refers to both the archaeologist’s professional reputation, but even more, to their site. The archaeologist’s final responsibility is publishing the results of the research project. Archaeological excavation destroys all or part of a site; unless the investigator publishes the results, vital scientific information will be lost forever. The ideal published scientific report includes not only the research design and hypotheses that have been formulated but also the data used to test them and to interpret the site or region so that the tests can be replicated by others.

People of the Past The Amesbury Archer, His Companion, and the Boscombe Bowmen: The People of Stonehenge, England, c. 2500 B.C.

In May 2002, a small gold ornament appeared in an excavation in advance of a new school building at Amesbury in southern England, just 3 miles (5 km) from Stonehenge. Andrew Fitzpatrick of Wessex Archaeology was so concerned about security that he decided to dig into the night. Car headlights illuminated the excavation, which ended at 1:42 A.M. The security precautions were worth it, for the dig uncovered the grave of a man known as the Amesbury Archer, who

lived in about 2500 B.C. as the great stones of Stonehenge were being erected.

The archer lay in a shallow grave as if he were asleep, accompanied by exceptionally rich offerings and equipped as an archer. He wore two gold hair or ear ornaments, the oldest such ornaments ever found in Britain. Copper knives, boar's tusks, well-made flint tools and arrowheads, and beaker pots lay with the archer, and behind his back was a carefully shaped black stone commonly used by ancient metalworkers. Two wrist guards—one black, the other red—protected his arms from his bowstring and also served as status symbols (see [Figure 5.4](#)).

Aged between 35 and 45 years when he died, the Amesbury Archer was not without pain. He suffered from many long-standing disabilities, notably a serious injury that had crippled his left knee. The infected bone would have caused him constant pain, and his left thigh withered as a result, causing him to walk with a limp. His collar and shoulder bones were relatively small and gracile, and although the prehistoric bow did not have the phenomenal draw-weight of the medieval longbow, there are no signs of uneven alignment of the arm muscles and bones that would have resulted from frequent use of a bow.

[Figure 5.4](#) Artist's reconstruction of the Amesbury Archer.

Source: Courtesy of Jane Brayne/Wessex Archaeology.

Judging from his bones, it is highly unlikely that the archer's main role was that of an archer. So why was he afforded one of the richest burials of the period? What message does that send? Was he a fit, handsome, powerful man, a great warrior or "prince"? Or was he a clever, dexterous fellow, perhaps capable of transforming materials from one state into another? Indeed, the "archer's" strong pronator muscle attachments may suggest that he was engaged in the fabrication of some of the artifact(s) that required strong wrist control and forceful movement. Interestingly several of the artifacts recovered from his grave suggest that he was—possibly among other things, a metalworker—an innovation that must have made him something of a magical alchemist.

Nearby him lay another burial, that of a 20- to 25-year-old man, known as the companion. He died later, but had gold ornaments identical to those of the “archer.” Because of the shape of the two men’s skulls and a rare genetic trait in their feet bones, we know that they were related, but whether they were father and son, brothers, or cousins, we cannot yet tell.

Fitzpatrick noticed at once that some of the objects in the “archer’s” grave, especially the copper knives, closely resembled artifacts from continental Europe. When the research team tested the oxygen isotope content of the two men’s tooth ivory, they were astounded to discover that while the companion had grown up in the Stonehenge area, the “archer’s” oxygen isotopes reflected a much colder climate, as if he had grown up in the Alpine region of southern Germany or Switzerland, where artifacts like his possessions are to be found.

The “Amesbury Archer” was apparently a widely traveled man, one who enjoyed considerable importance, presumably because of his metalworking skills—which may have accounted for his wide travels. It was probably no coincidence that he lived close to an important ritual center, such as Stonehenge.

A year later, in May 2003, fragments of human bones and beakers, along with flint arrowheads identical to those from the “archer’s” grave, came from a communal burial on the air base at Boscombe Down a short distance away, and again, close to Stonehenge. The complete skeleton of a 30- to 40-year-old man, with an imperfectly healed broken left leg, lay in the grave pit, along with the fragmentary remains of at least 8 other people, and possibly as many as 19, mainly men.

Collectively, they are known as the Boscombe Bowmen. Most of the bones were skulls and limb bones, many of which had been buried elsewhere, then reinterred. Close similarities between the skulls linked everyone to a close-knit community. But strontium and oxygen isotopes yielded another surprise. The men in the grave had spent their early years in Wales. The first stones erected at Stonehenge were bluestones from the Preseli Hills in Wales, over 150 miles (240 km) from the great monument. Could the Boscombe Bowmen have been involved in the laborious transportation of the bluestones and then in the building of Stonehenge? With high-technology science, the creators of this stupendous monument are slowly emerging from the prehistoric

shadows (Fitzpatrick, 2011).

The graves and their contents illustrate how the various strands of detailed archaeological research can be drawn together to construct life histories—telling us about the people, where they came from, their relationships with one another, and all aspects of lifestyle and place in society. Any assumptions that in the past, “survival of the fittest” was the rule, is clearly oversimplistic. It seems there was more to Early Bronze Age/Beaker society than just physical prowess.

All archaeological research is cumulative, in the sense that everyone’s investigations are eventually superseded by later work, which uses more refined methods of recovery and new analytical approaches. But unless every archaeologist publishes the results of his or her completed work, the chain of research will be incomplete, and a fragment of human history will vanish into oblivion. It is sad that the pace of publication has been far behind that of excavation. The reason is not hard to discern: Excavating is far more fun than writing reports!

In recent years, more and more researchers are turning to the internet and digital publication as a way of making basic data available to fellow archaeologists and other interested parties. At Çatalhöyük, Turkey, Ian Hodder and his research team have made each season’s data freely accessible through the site’s web page in order to generate discussion of their research (Hodder, 1999; <http://catal.arch.cam.ac.uk/catal/catal.html>). Today, with most excavations of any size, archaeologists try to share their results with the public, both during and after the fieldwork.

Summary

1. Modern archaeology makes use of scientific methods devised by archaeologists and by scientists in many other disciplines.
2. A well-qualified archaeologist commands many skills, not only in archaeological method and theory but also in practical methodology. This expertise includes the ability to select and work with specialists in other academic disciplines. Practical fieldwork experience and considerable administrative and managerial skill are also requirements on even the smallest

research project. All archaeologists have to acquire precise analytical and writing skills to enable them to communicate their results and record them for posterity.

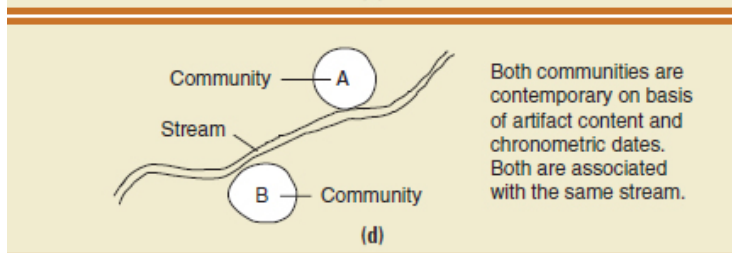
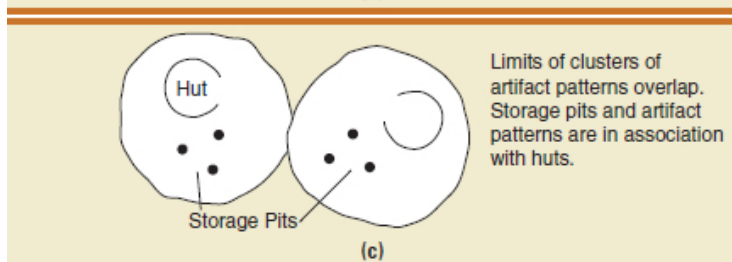
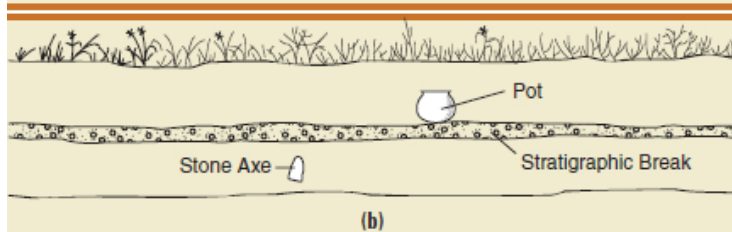
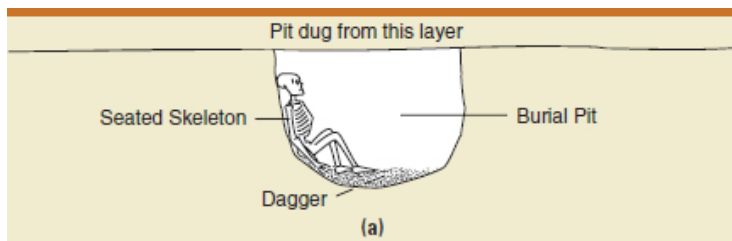
3. Archaeologists use science as a means of acquiring knowledge and understanding about the parts of the natural world that can be observed. They do so by working with two forms of reasoning: inductive reasoning, which takes specific observations and makes a generalization from them, and deductive reasoning, which starts with a generalization and proceeds to specific implications.
4. The process of archaeological research begins with formulating highly specific research designs that are flexible enough to allow changes in the overall project as field research proceeds. The research project is formulated to fit the problem to be investigated and the geographic area involved. Formulation means carrying out background research and then developing hypotheses to be tested against data acquired in the field.
5. Once the field team has been assembled, members acquire data by reconnaissance, site survey, and excavation. This acquisition requires them to record provenance, archaeological context, and a great deal of basic information about the site, its natural environment, and its archaeological finds.
6. The processing of archaeological data requires analyzing and interpreting the archaeological finds, which involve sorting, classifying, and ordering the finds, then testing the hypotheses developed as part of the research design.
7. The final stage in archaeological research is publishing the results as a permanent record for posterity.

Further Reading

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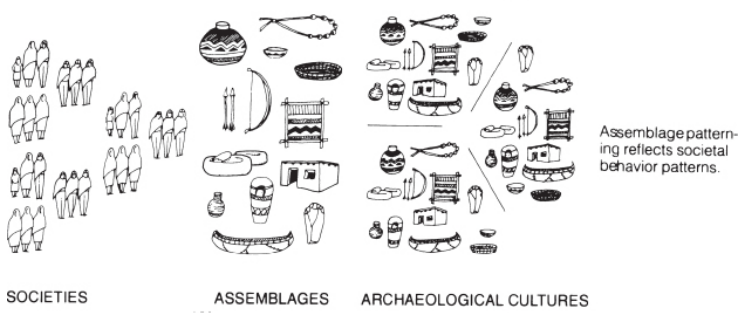
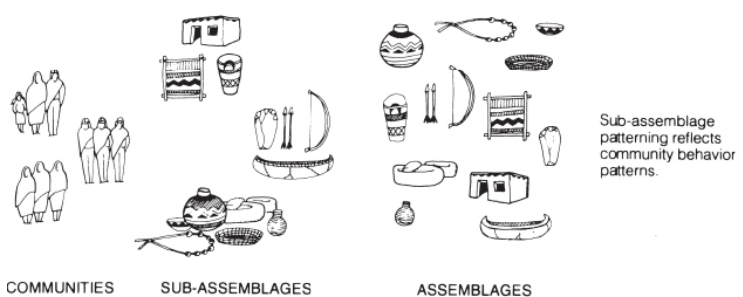
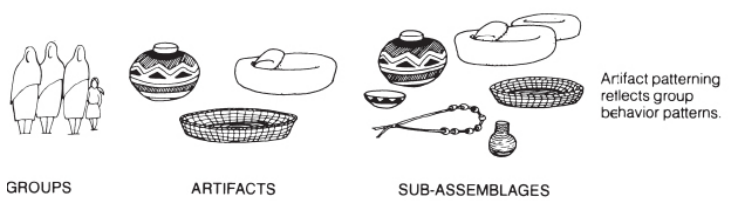
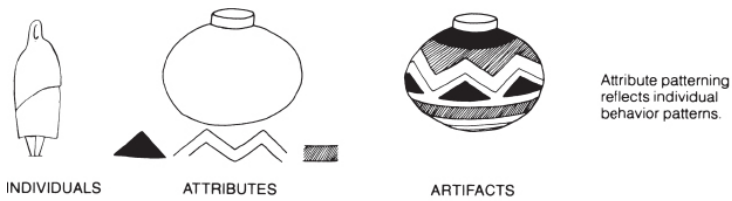












CHAPTER OUTLINE

The Concept of Culture

The Nature of Culture

Models of Culture

The Archaeological Record

Matrix and Provenance

Archaeological Context

Artifacts, Subassemblages, and Assemblages

Archaeological Sites

Cultures, Areas, Regions, and Settlement Patterns

Victorian excavation at its most dramatic and unscientific. M. De Morgan lifts a golden crown from the mummy of Queen Khnemit at Dahshur, Egypt, 1896.

Source: Courtesy of North Wind Picture Archives/Alamy Stock Photo.

This chapter introduces some basic concepts of archaeological research to culture and to data in the form of artifacts and their matrix, provenance, and context (see also Sharer and Ashmore, 2013; Thomas and Kelly, 2013). The provenance and context of all archaeological data are based on two fundamental laws: association and superposition. From basic concepts, the chapter moves on to discuss spatial context—not the limitless frontiers of the heavens but a precisely defined location for every find made during an archaeological survey or excavation.

The Concept of Culture

In [Chapter 1](#) we said that “anthropologists study human beings as biological organisms with a unique characteristic—culture.” Few concepts in anthropology have generated as much controversy and academic debate as those expressed in that statement (Kroeber and Kluckhohn, 1952). All definitions of culture, one of the most elusive of theoretical formulations, are a means of explaining societies and human behavior in terms of the shared ideas a group of people may hold. One of the best definitions of culture was proposed by the great Victorian anthropologist Sir Edward Tylor more than a century ago. He stated

that **culture** is “that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society” (1878). To that definition, modern archaeologists would add that culture is our primary means of adapting to our environment. Tylor’s definition, and all other such formulations, agree on one important point: Culture and human behavior are shared ideas that a group of people may hold.

Culture is a distinctively human attribute, for we are the only animals to use our culture as our primary means of adapting to our environment. It is our adaptive system. Although biological evolution has protected the polar bear from Arctic cold with dense fur and has given the duck webbed feet for swimming, only human beings make thick clothes and igloos in the Arctic and live with minimal clothing under light, thatched shelters in the tropics. We use our culture as a buffer between ourselves and the environment, a buffer that has become more and more elaborate through the long millennia of prehistory. We are now so detached from our environment that removal of our cultural buffer would render us almost helpless and would probably lead to the extinction of the human species in a very short time.

Thus, human cultures are made up of human behavior and its results; they obviously consist of complex and constantly interacting variables. Human culture, never static, is always adjusting to both internal and external change, whether environmental, technological, or societal. Increasingly, humans have modified the natural environment to such an extent that they have created their own.

The Nature of Culture

Culture can be subdivided in all sorts of ways—language, economics, technology, religion, political or social organizations, and art. But human culture as a whole is a complex, structured organization in which all of our categories shape one another. All cultures are made up of myriad tangible and intangible traits, the contents of which result from complex adaptation to a wide range of ecological, societal, and cultural factors. Much of human culture is transmitted from generation to generation by sophisticated communication systems that permit

complex and ceaseless adaptations to aid survival and help rapid culture change take place—as when less-advanced societies come into contact with higher civilizations.

Everyone lives within a culture of some kind, and every culture is qualified by a label, such as “middle-class American,” “Eskimo,” or “Masai.” The qualification conjures up characteristic attributes or behavior patterns typical of those associated with the cultural label. One attribute of a middle-class American might be the hamburger; of the Eskimo, the kayak; of the Masai, a long-handled, fine-bladed spear. Elite members of Maya society are associated with elaborate cities and intricate **hieroglyphs**, ancient writing featuring picture or ideographic symbols. Our mental images of cultures are associated with popular stereotypes, too. To many Americans, Chinese culture conjures up images of paper lanterns and willow-pattern plates; French culture, good eating and fine wines. We are all familiar with the distinctive “flavor” of a culture that we encounter when dining in a foreign restaurant or arriving in a strange country. Every culture has its individuality and recognizable style, which shape its political and judicial institutions and morals.

DISCOVERY CELEBRATING FINDS AT CARCHEMISH, SYRIA

Some early archaeologists in Egypt and parts of southwestern Asia worked with enormous teams of workers by modern standards. The workforce on Flinders Petrie’s Egyptian digs in the 1890s numbered in the hundreds, as did those at Ur in Iraq in the 1920s and 1930s. Leonard Woolley of Ur fame excavated the Hittite city at Carchemish on the Euphrates River in Syria just before World War I. He and his colleague T. E. Lawrence (later to achieve worldwide fame as “Lawrence of Arabia”) not only excavated the great city but also spied on German engineers building a nearby railroad to Baghdad.

Woolley was a born leader of Arab workers. He worked closely with his foreman, Sheikh Hamoudi, famous among archaeologists of the day for his ability to lead Arab workmen and for his swearing. The mood at the Carchemish excavations was always lighthearted. Woolley and Hamoudi celebrated each important discovery with a rifle volley, the

number of cartridges denoting the significance of the find. The volleys became a form of competition that were a badge of honor for the workers and a celebration of discovery. The workers labored in teams, with the job of pickman being especially prized, for the chance of receiving a volley for that job was much higher. But Woolley made sure that basket carriers who found something of significance were given an extra-large volley to ensure that eyes were always open.

Woolley himself admitted that the system appeared childish, but he encouraged it as a way of making the excavation proceed smoothly, more than what he called “a mere business.” He hated dull excavations and enjoyed the company of workers who were fiercely loyal to him. The process of discovery was a game pursued with deadly seriousness and on a scale and with methods that would never be tolerated today.

Unfortunately, cultural labels often become simplistic and sometimes demeaning stereotypes, such as that of the Native Americans as “feathered braves” or of the French as romantic, consummate lovers. Since each culture is ever-changing and ever-renegotiated by its members, cultural reality is much more complex and often deeply challenging for an outsider to penetrate and comprehend.

Archaeologists think of culture as possessing three components:

1. The individual’s own version of his or her culture—the diversified individual behavior that makes up the myriad strains of a culture. Individual decisions play a vital role in changing even elaborate cultures.
2. Shared culture—elements of a culture shared by everyone. These can include cultural activities such as human sacrifice, ritualized warfare, or any other human activity, as well as the body of rules and prescriptions that make up the sum of the culture (see [Figure 6.2](#)). Language is critical to this sharing, and so is the cultural system.
3. The cultural system—the system of behavior in which every individual participates. The individual not only shares the cultural system with other members of society but also takes an active part in it.

Culture, then, can be viewed as either a blend of shared traits or a

system that permits a society to interact with its environment (see [Figure 6.1](#)). To do anything more than merely work out chronological sequences, the archaeologist has to view culture as a group of complex, interacting components. These components remain static unless the processes that operate the system are carefully defined. Archaeologists are deeply involved with **cultural process**, the processes by which human societies changed in the past.

[Figure 6.1](#) The Aztec Indians of Mexico sacrificed human victims to the Sun God Huitzilopochtli in the belief that the blood of human hearts nourished the sun on its journey across the heavens. This belief was part of the shared culture of this society. This drawing from the so-called Florentine Codex shows a priest offering a human heart to the sun.

Source: Courtesy of World History Archive/Alamy Stock Photo.

In archaeology, the notion of **cultural systems** has come into use as a general concept to help us understand the ever-changing relationship between human cultures and their environment. It is derived from general systems theory, a body of theoretical concepts formulated as a means of searching for general relationships in the empirical world (Watson et al., 1984). Archaeologist Stuart Struever (1971: 188) defines a cultural system as follows: “Culture and its environments represent a number of articulated [interlinked] systems in which change occurs through a series of minor, linked variations in one or more of these systems.” For example, an Eskimo cultural system is part of a much larger Arctic ecosystem. The cultural system itself is made up of dozens of subsystems: an economic subsystem, a political subsystem, and others. If the climate changes suddenly, there might be a switch from reindeer hunting to fishing and sealing, triggering all sorts of linked shifts, not only in the economic subsystem but also in the technological and social subsystems. A cultural system is in a constant state of adjustment within itself and with the ecosystem of which it is a part.

Many of the interacting components of culture are highly perishable. So far, no one has been able to dig up an unwritten language. Archaeologists have to work with the tangible remains of human activity that still survive in the ground. But these surviving remains of human activity are radically affected by intangible aspects of human

culture. For example, the Hopewell people of the American Midwest traded finely made ornaments fashioned out of hammered copper sheet over enormous distances 1,800 years ago. These ornaments turn up in Hopewell burial mounds. The copper technology that made them was simple but the symbolism behind the artifacts was not. They were probably exchanged between important individuals as symbolic gifts, denoting kin ties, economic obligations, and other intangible social meanings that are beyond the archaeologist's ability to recover (Fagan, 2019).

The notion of cultural systems is a useful conceptual framework, provided one does not take it too far and apply it like a rigid, mechanistic formula. We should never forget that our forebears were human beings like ourselves. They made decisions as individuals and as groups, as friends, enemies, neighbors, lords, or commoners; therefore, it is impossible to apply universal rules of cultural behavior to humanity. The archaeologist thus faces much greater limitations in research than the ethnographer, who works with living societies and can talk to individuals.

Models of Culture

Normative Models

Franz Boas (1858–1942), often called “the father of American anthropology,” had a profound influence on early American archaeology, for he developed what is often called a normative view of culture. This was the first concept of culture to be applied to archaeology, the notion that all human behavior is patterned, and the forms of the patterns being determined very largely by culture. This rubric envisages a set of rules or norms, for behavior within any society, which passes from one generation to the next. There are, of course, individual variations, for all the norms do is define the range of acceptable behavior.

Boas applied the **normative view of culture** to contemporary societies, but archaeologists often use it to examine societies evolving over long periods. Anthropologists try to abstract the norms of human behavior by observing societies over many months, even years. They

are searching, as it were, for the “grammar” of a society. Archaeologists use the material remains of the archaeological record, such as pottery or stone tools, to infer human behavior, arguing that such durable artifacts represent norms of technological behavior, if nothing else. They assume that implicit rules governed the manufacture of all kinds of artifacts over many generations.

This descriptive approach allows archaeologists to reconstruct and observe variations and changes in what they call behavioral norms. It has been very successful in working out detailed, descriptive outlines of human prehistory at the local and regional levels. However, it does not address two critical goals of archaeology: reconstructing past lifeways and explaining culture change.

Functional Models

Bronislaw Malinowski (1884–1942) was one of the great anthropologists of the early twentieth century, famous for his observations of the Trobriand Islanders in the western Pacific and for his functional model of culture (functionalism). Culture to Malinowski and other functionalist anthropologists, such as E. E. Radcliffe-Brown (1931), who worked among the Nuer of the Sudan, was “inherited artifacts, goods, technical processes, ideas, habits, and values.” Malinowski went much farther than Boas, arguing that each human culture was a set of closely interrelated mechanisms designed to satisfy social and survival needs, not just for individuals but for society as a whole. Thus, the nature of any society could be understood only by looking at the network of complex relationships that formed the underlying structure of that society. Each component of a cultural system, living or prehistoric, has a specific function, be it stone technology, ways of growing crops, or residence rules after marriage. Each function is connected to myriad others by a network of relationships, forming an ever-adjusting cultural system.

Functionalism can be a somewhat historical way of looking at human societies, but archaeologists have found it to be of considerable use in examining individual artifacts and culture traits as part of a much larger network of functional relationships. However, in one aspect functionalism diverges greatly from more recent ecological

models of culture, which view cultural systems not as self-regulating but as undergoing constant change as they adapt to their natural environments.

Processual Models

The processual approach reflects archaeology's gradual shift away from mere description of the past to models based on hypothesis-testing strategies, cultural ecology, and multilineal cultural evolution (see [Chapter 3](#)). Some archaeologists even toy with the idea of not using the concept of culture at all.

Systems theory deals with relationships and variations in relationships; in other words, it deals with precisely the phenomena involved in explaining the processes by which cultures change. Modern scientific archaeology analyzes the causes of culture change, that is, cultural process.

The word *process* implies a patterned sequence of events that leads from one state of affairs to another. This patterned sequence is determined by a decision-making process that sets the order of events. A 40-foot (12 m) sailing yacht starts as a pile of materials—wood, aluminum, copper, bronze—and then a patterned sequence of manufacturing events turns the material into a gleaming new ship. Archaeology is a process, too. It involves designing the research project, formulating the hypothesis from prior research, collecting and interpreting new data to test the hypothesis, and finally, publishing the results.

Conditions are events that force people to make decisions about how to deal with new situations. As such, they are distinct from the actual process of decision making, the mechanism that leads to any kind of change. A change in the natural environment from year-round rainfall to a seasonal pattern is a condition.

In archaeology, cultural process refers to the “identification of the factors responsible for the direction and nature of change within cultural systems” (Sharer and Ashmore, 2009: 56). Processual archaeology is analysis of the conditions of culture change, which involves looking at relationships among variables that could lead to culture change. These possible conditions are then tested against actual

archaeological data, sometimes in a systems theory context.

Clearly, no one element in any cultural system is the primary cause of change; instead, a complex range of factors—rainfall, vegetation, technology, social restrictions, population density—interact with and react to changes in any element in the system. It follows, then, that human culture, from the ecologist's viewpoint, is merely one element in the ecosystem, a mechanism of behavior whereby people adapt to an environment (Figure 6.2).

Postprocessual Models

Unlike the “processualists,” archaeologists who work with postprocessual theory are little interested in general cultural systems that can be scientifically tested or deduced. Instead, their primary concern is to find out (or at least aim to find out) what unique ideas people were trying to express through their material culture. According to this approach, archaeological sites are texts to be read rather than materials to be analyzed in order to decipher the individual cultural system behind them. Materials were often constructed as a form of self-expression: Stonehenge, with the intricate beliefs behind it, is a good example. Thus, much archaeological research is interpretation rather than merely observation of the operation of a cultural system.

Such approaches are reflexive; that is to say, they are constantly self-critical and allow for many different viewpoints—a multivocality (Hodder, 1999). The task for the archaeologist is to define stratigraphic units, not discover them, for what we call the archaeological record is made by archaeologists, not just something that occurs.

Figure 6.2 Two Hadza men from Lake Eyasi, Tanzania, East Africa, make fire by twirling a hardwood drill in softwood. Human culture is, from the ecologist's point of view, merely one element in the ecosystem.

Source: Courtesy of PhotoStock-Israel/Alamy Stock Photo.

The Archaeological Record

The **archaeological record** (or, as it is sometimes called, the “archaeological resource”) is the general name denoting the more or less

continuous distribution of artifacts over the earth's surface, in highly variable densities. Variations in artifact densities reflect the character and frequency of land use, making them an important variable that the archaeologist can measure (Dunnell and Dancey, 1983). Some high-density clusters of artifacts may be subsumed under the term site. Although archaeological record refers specifically to distributions of artifacts, it can also include the following:

- **Artifacts:** in the strict sense, objects manufactured or modified by humans.
- **Features:** artifacts and artifact associations that cannot be removed intact from the ground, such as postholes and ditches.
- **Structures:** houses, granaries, temples, and other buildings that can be identified from standing remains, patterns of postholes, and other features in the ground.
- **Ecofacts:** sometimes refers to food remains, such as bones, seeds, and other finds, which throw light on human activities.

Data are the materials recognized by the archaeologist as significant, all of which are collected and recorded as part of the research. Data are different from “facts,” which are simply bits of observable information about objects, conditions, and so on. Archaeological data are sometimes referred to as evidence. Archaeological data do not consist of artifacts, features, structures, and ecofacts alone; however, they also include their context in space and time.

Matrix and Provenance

All scientifically collected or excavated archaeological finds, be they a complete site or a lone object, occur within a matrix and have a specific provenance. The *matrix* (described in [Chapter 4](#)) is the physical substance that surrounds the find. It can be gravel, sand, mud, or even water. Most archaeological matrices are of natural origin; passing time and external phenomena, such as wind and rainfall, create them. The early bone caches at Olduvai Gorge in Tanzania were at the edge of a shallow and ever-fluctuating lake 1.75 million years ago. The scatters of tools and bones left by the departing hominins were soon covered by a

layer of thin lake sand carried by advancing shallow water. This matrix preserved the tools in their original positions for thousands of millennia (Leakey, 1971). An archaeological matrix can also be humanly made, such as the huge earthen platforms of Hopewell burial mounds in the American Midwest.

Provenance (or provenience) is the precise three-dimensional position of the find within the matrix as recorded by the archaeologist. It is derived from accurate records kept during excavations and site surveys, from evidence that is inevitably destroyed as a site is dug or artifacts are collected from a surface site. Every human artifact has a provenance in time and space. The provenance in time can range from a radiocarbon date of $1,400 \pm 60$ years before the present for a Maya temple, to a precise reading of A.D. 2020 for a dime released by the U.S. Mint.¹ Frequently, it can simply be an exact position in an archaeological site whose general age is known. Provenance in space is based, finally, on associations between tools and other items that were results of human behavior in a culture. Provenance is determined by applying two fundamental archaeological principles: the principle of association and the principle of superposition.

1 Conventional archaeological usage is B.P. (years before present), with “present” being A.D. 1950 by international agreement, and also A.D./B.C., dates calculated relative to the date of Christ’s birth. Some archaeologists use C.E./B.C.E. (“Common Era,” “Before Common Era”) instead of A.D./B.C.

The Principle of Association

The archaeological principle of **association** (Figure 6.4) was first stated by Danish archaeologist J. J. A. Worsaae when he was excavating prehistoric burials in 1843:

The objects accompanying a human burial are in most cases things that were in use at the same time. When certain artifact types are found together in grave association after grave association, and when more evolved forms of the same tools are found in association with other burials, then the associations provide some basis for dividing the burials into different chronological groups on the basis of association and artifact styles.

(Worsaae, 1843: 10)

Instances of archaeological associations are legion (see [Figure 6.4](#)). The first evidence of high antiquity for humankind came from associations of stone axes and the bones of extinct animals discovered in the same geological layers. Many early Mesoamerican farmers' houses are associated with storage pits for maize and other crops. In this and many other cases, the horizontal association between artifacts and houses, dwellings and storage pits, or artifacts and food residues provides the archaeological association. Much of the most valuable archaeological data are derived from precise studies of associations between different finds in the ground.

The Principle of Superposition

The time dimension of archaeology is erected on basic principles of stratigraphic geology and the principle of **superposition** set down by the uniformitarians early in the nineteenth century (see [Chapter 2](#)). The principle of superposition states that the geological layers of the earth are stratified one upon another, like the layers of a cake. Cliffs by the seashore and quarries are easily accessible examples. Obviously, any object found in the lowermost levels, whether a stone or something humanly made, was deposited there before the upper levels were accumulated. In other words, the lower strata are earlier than the upper strata. The same principle applies to archaeological sites: The tools, houses, and other finds in one layer of a site can be dated relative to the other layers (see [Figure 6.3](#)). The different layers are known as strata, and the number of strata can vary wildly according to the complexity of the site. However, the ideal basis of all scientific archaeological excavation is to accurately observe and record these strata in order to produce a **stratigraphic profile** for the site (see [Chapter 9](#)).

Archaeological Context

Archaeological context is derived from careful recording of the matrix, provenance, and association of the finds. **Context** is far more than just a find spot, a position in time and space. It involves assessing how the find got to its position and what happened after its original owners abandoned it. Anyone wanting to reconstruct human behavior or

ancient cultural systems must pay careful attention to the context of every find.

Figure 6.3 Archaeological associations: (a) A burial pit, dug from the uppermost layer, contains a skeleton and a dagger close to its feet. The dagger is associated with the skeleton; both finds are associated with the burial pit and the layer from which the grave pit was cut into the subsoil. (b) In contrast, a pot and a stone ax are found in two different layers, separated by a sterile zone, a zone with no finds. The two objects are not in association. (c) Two household clusters with associated pits and scatters of artifacts are in association with each other. (d) An association of two contemporary communities.

Three factors affect context:

1. The manufacture and use of the object, house, or other find by its original owners. The orientation of a house may be determined by the position of the sun on summer afternoons. Because the archaeologist's objective is to reconstruct past behavior, this aspect of context is vital.
2. The way in which the find was deposited in the ground. Some discoveries, such as burials or caches of artifacts, were deliberately buried under the ground by ancient people; others got there as a result of natural phenomena. Houses that have been abandoned are slowly covered by blowing sand or rotting vegetation, or houses may be buried quickly, as was the Roman city of Herculaneum in Italy, which was covered by volcanic ash in an eruption of Vesuvius in August A.D. 79.
3. The subsequent history of the find in the ground. Was the burial disturbed by later graves, or was the site eroded away by water?

Figure 6.4 A case of association. A richly decorated warrior-priest of coastal Peru's Moche state, known as a Lord of Sipán, lies in his grave of about A.D. 400 associated with sacrificial victims and elaborate grave offerings.

Source: Courtesy of Sue Cunningham Photographic/Alamy Stock Photo.

Primary and Secondary Context

The context of any archaeological find can be affected by two processes: the original behavior of the people who used or made it and the events

that came later. **Primary context** is the original context of the find, undisturbed by any factor, human or natural, since it was deposited by the people involved with it (Figure 6.4). The remarkably well preserved Stone Age houses at Skara Brae in Orkney still contain their original furniture, a primary context if ever there was one (Figure 6.5).

Secondary context refers to the context of a find whose primary context has been disturbed by later activity. Very frequently, excavators of a burial ground will find incomplete skeletons whose graves were disturbed by deposition of later burials. For example, in 500 B.C. , a group of Chumash Indians camped by a rocky peninsula on the south side of Santa Cruz Island off southern California. Their ancestors had collected shellfish and hunted sea mammals at this location for untold generations. They camped for several days, nursing a sick man. After he died, they buried his body in the large shell heap downwind of their camp, and moved away. Fifty years later, another group visited the same spot and buried two children in the same mound. As they dug their graves into a corner of the original sepulcher, they disturbed the bones of the long-forgotten ancestor. When archaeologists uncovered the burials centuries later, they referred to the later interments as secondary burials. Incomplete skeletons can also occur when a group exposes the dead until the corpse has decomposed, then buries the bones in a bundle in a communal burial chamber, such as a British Stone Age long barrow or a Hopewell mound in the Ohio Valley.

Figure 6.5 Primary contexts. A semisubterranean Stone Age house at Skara Brae, Orkney, Scotland, dating to circa 3000 B.C. , showing the furniture still in its original positions—a primary context.

Source: Courtesy of Paul Glendell/Alamy Stock Photo.

S i T E > The Siege of Maiden Castle, England <

Maiden Castle is a classic example of a well-stratified and highly complex archaeological site that has undergone meticulous excavation (Figure 6.6). It is an Iron Age hill fort that was occupied by a Celtic tribe at about the time of Christ. The fort lies on a ridge, visible from a long way off because of its serried, steep-sided earthworks and ditches. Two thousand years ago, the now-grass-covered fortifications would

have gleamed brightly, even on a cloudy day, the white soil of the exposed chalk subsoil standing out in the grassy landscape. By the standards of its time, Maiden Castle was a powerful fortress, with entrances protected by multiple earthworks topped with wooden palisades designed to protect the inhabitants from arrows, slingshots, and other long-distance weapons. Inside, the local tribespeople lived in a large settlement of circular, thatched houses on the site of a much older Stone Age camp. In A.D. 43, the Roman general Vespaian's Second Legion attacked the fort in an assault on the lower, eastern end. The successful attack killed many of the villagers; survivors dispersed elsewhere.

In 1934, 1,900 years later, archaeologist Mortimer Wheeler excavated Maiden Castle in one of the classic archaeological digs of all time. Wheeler and his then-wife Tessa brought refined digging methods to Maiden Castle. The site was so complex that Wheeler developed horizontal and vertical trenching systems to investigate the history of the earthworks and to expose a large area at the eastern end of the fort. He dug with paid laborers and volunteers, many of whom went on to become prominent archaeologists in their own right. In 1937, Wheeler uncovered traces of the Roman attack, which were reconstructed in a classic piece of archaeological writing. He described (1943) how Vespaian brought up siege artillery, which laid down a barrage as the infantry advanced, cutting its way from rampart to rampart, tower to tower. A huddle of dwellings found in the excavations lay just outside the sealed gates. The Romans set fire to them and stormed the gates under the cover of the smoke. "The fury of the attackers was aroused. Men and women, young and old, were savagely cut down before the legionaries were called to heel and the work of systematic destruction began" (Wheeler, 1943: 112). In a great, if imaginative, piece of archaeological writing, Wheeler tells how the survivors returned after dark and hastily buried their dead, one with an iron arrowhead deep in his spine.

Few archaeological excavations can tell such a vivid tale. Although details of Wheeler's reconstruction have been challenged, his account still stands.

Figure 6.6 The earthworks of Maiden Castle, Dorset.

Source: Courtesy of Skyscan Photolibrary/Alamy Stock Photo.

As in the tomb of pharaoh Tutankhamun, tomb robbers may disturb the original grave furnishings while searching for gold or precious oils. In still other instances, finds can be shifted by the natural forces of wind and weather. Many of the Stone Age tools found in European river gravels were transported by floodwaters to a location far from their original place of deposition. All these disturbed finds are in a secondary context.

Spatial Context

Spatial context is the distance between different objects or features, between entire settlements, or between settlements and key vegetational zones, and landmarks. Important distances can be a few inches of level ground between a dagger and the associated skeleton of its owner, a mile separating two seasonal camps, or a complicated series of interrelated distance measurements separating dozens of villages that are part of an elaborate trading system carrying goods through several geographic regions hundreds of miles apart.

One can identify four dimensions of variability in human behavior reflected in spatial context:

1. **Artifact:** individual human activity.
2. **Structure:** household or group activities. (Structures can, of course, include public buildings, such as temples, which are used by more than one household.)
3. **Site:** community activity, groups of contemporary houses, stores, temples, and other structures.
4. **Region:** the activities of groups of people reflected by the distribution of sites on the landscape, sometimes referred to as a settlement pattern.

These four levels of spatial context are closely tied to actual cultural behavior (see [Figure 6.7](#)). An artifact itself can provide valuable information on technology and actual use. But to infer cultural behavior we must know the artifact's association, both with other artifacts and with the matrix in which it was found. The patterning of

artifacts in space around an abandoned iron-smelting furnace or near the bones of a slaughtered bison kill is tangible evidence of specific human behavior. An unassociated projectile point will never indicate anything more specific than the inference that it was used as a weapon. But a patterning of projectile points, scraping tools, and large boulders associated with a bison skeleton has a context in time and space that allows much more detailed inferences.

The basic assumption behind all studies of artifacts in space is that they were used for different purposes and that characteristic groups of them were used for specific activities, such as ironworking, butchery, and hunting. It follows that similarly patterned groups of artifact types found on other sites resulted from similar activities, even if they show differences in detail. During the earlier millennia of the Stone Age, people enjoyed much the same level of hunting and gathering culture throughout Africa, Europe, and India. This parallel is reflected in thousands of similar-looking stone axes found in sites as widely separated as the Thames Valley in England and the Cape of Good Hope in South Africa.

Artifacts, Subassemblages, and Assemblages

As we saw in [Chapter 4](#), archaeological data comprise the material remains of ancient human behavior. These data come in many forms, and a fundamental part of archaeological research involves classifying and interpreting the data, creating order out of a jumble of artifacts and other finds.

The process of classification involves making judgments about different categories of finds (see [Chapter 10](#)). Archaeologists have terms that define these remains for research purposes, arbitrary groupings used for archaeological analysis, which may, or more often may not, represent “real” things in the past. In other words, data groups are instruments used in research, not actual cultural phenomena, even if sometimes they coincide with them.

Artifacts

Artifacts are commonly defined as items that exhibit any physical

attributes that can be assumed to be the result of human activity. This definition implies that the term *artifact* covers every form of archaeological find, from stone axes, bronze daggers, and clay pots to butchered animal bones, carbonized seeds, huts, and all other manifestations of human behavior that can be found in archaeological sites. Some archaeologists define artifacts by breaking them down into four categories: portable artifacts, features, structures, and ecofacts. Whichever definition is preferred, all assume that any object or any event of manufacture or consumption is a product of human activity if its location or any other of its features cannot be accounted for by natural processes (Deetz, 1967). In other words, artifacts are compared with natural objects and distinguished from them, not by individual features but by a patterning of different, human-caused features. It is this patterning that is important. A simple flake removed from an elaborate ceremonial obsidian knife blade may not necessarily show evidence of human modification. But the patterned, consistently repeated finding of several dozen or hundreds of small flakes—the pattern forming a knife—is highly diagnostic of human activity. Normally there is no difficulty in telling artifacts made or caused by humans from those caused by water action, fire, animal kills, or other natural phenomena (but see Lyman, 1994).

Figure 6.7 Human behavior as reflected in archaeological classification. The hierarchy begins with attributes and artifacts and ends with entire archaeological cultures. (From James Deetz, *Invitation to Archaeology*. New York: Doubleday, 1967. Copyright © 1967 by James Deetz. Used by permission of Doubleday, a division of Random House, Inc.)

Subassemblages

An artifact, such as an arrowhead or a basket, is made up of a combination of attributes (minor features) that make up a constant pattern of behavior reflected in the finished artifact (see [Chapter 10](#)). When such artifacts are found in patterned associations reflecting the shared cultural behavior of minimal groups, they are commonly classified in **subassemblages**. A hunter uses a bow, arrows, and a quiver; a blacksmith uses hammers, tongs, and bellows; and so on. Subassemblages represent the behavior of individuals and are often tool

kits.

Assemblages

When a number of subassemblages of artifacts—say, a collection of hunting weapons, baskets, pounders, digging sticks, traces of windbreaks, and stone vessels—are found in a contemporaneous association, they reflect in their patterning the shared activities of a total community and are known as **assemblages**. With assemblages, one is looking at the shared behavior of a community as a whole, which frequently is reflected in the remains of houses, the features associated with them, and community settlement patterns.

Archaeological Sites

Sites are places where traces of past human activity are to be found. They represent accumulations of the remains of human behavior over periods of time. Sites are normally identified by the presence of artifacts. They can range in size from a large city, such as Teotihuacán in the Valley of Mexico, to a tiny scattering of hunter-gatherer artifacts, such as those in Death Valley, California. There are millions of archaeological sites in the world, many of them still undiscovered. Some were occupied for a few hours, days, or weeks; some for a generation or two and then abandoned forever. Other localities, such as Mesopotamian city mounds, or *tells* (Arabic: mound or hill), were occupied again and again for hundreds, even thousands, of years and contain many stratified layers. In contrast, an occupation site may contain little more than a surface scattering of potsherds, or stone tools, or an occupation layer buried under a few inches of topsoil. In a sense, archaeological sites are a paradox. They may represent long-term communal behavior over, say, 300 or 1,000 years, but what the archaeologist actually finds may be the remains of a very brief episode of such behavior, perhaps the filling of a storage pit, which took ten minutes on July 4, A.D. 1250.

Archaeological sites can typically be classified in the following ways:

- By archaeological context. The context of artifacts in the site can be used to distinguish between sites such as surface locations,

single-level occupations, and stratified settlements.

- By artifact content. The site is labeled according to its specific artifact content: pottery, stone tools, milling stones, and so on. The associations, subassemblages, and assemblages of artifacts in the site are used to label it as Stone Age, Maya, and so on.
- By geographic location. Most human settlements have been concentrated in well-defined types of geographic locations, and these sites can be referred to as cave sites, valley bottom sites, foothill sites, and the like.
- By artifact content related to site function. Because subassemblages reflect individual human behavior, sites can be classified by the characteristic patterning of the artifacts found in them, such as kill sites and habitations.

Using these criteria, researchers identify several broad site functions, which are commonly used by archaeologists everywhere (see the Doing Archaeology Box).

Doing Archaeology Common Site Functions

Living or *habitation sites* are the most important sites, for they are the places where people have lived and carried out a multitude of activities. The artifacts in living sites reflect domestic activities, such as food preparation and toolmaking. Dwellings are normally present. The temporary camps of California fisherfolk are habitation sites, as are Stone Age rock shelters, Southwestern pueblos, and Mesopotamian tells. Habitation sites of any complexity are associated with other sites that reflect specialized needs, such as agricultural systems, cemeteries, and temporary camps.

Kill sites are places where prehistoric people killed game and camped around the carcasses while butchering the meat. They are relatively common on the Great Plains; the Olsen-Chubbuck site is a good example (see [Figure 8.5](#) on page 133). Projectile points and butchery tools are associated with kill sites.

Ceremonial sites may or may not be integral to a living site. The Mesopotamian *ziggurat* (temple mound) dominated its mother city, and Maya cities such as Tikal boasted imposing ceremonial precincts surrounded by habitation areas. Other famous ceremonial sites, such as

Stonehenge in England and the Great Serpent Mound in Ohio, are isolated monuments, even if they sit within larger landscapes. Ceremonial artifacts, such as stingray spines used in mutilation rituals, and statuary may be associated with sacred sites.

Burial sites include both cemeteries and isolated tombs. People have been burying their dead since at least 50,000 years ago and have often taken enormous pains to prepare them for the afterlife. Perhaps the most famous burial sites of all are the pyramids of Giza in Egypt. Royal burials, such as that of the Egyptian pharaoh Tutankhamun, absorbed the energies of hundreds of people in their preparation. Many burials are associated with special grave furniture, jewelry, and ornaments of rank.

Trading, quarry, and art sites form a special category in that some kind of specialist activity was carried out. The special tools needed for mining obsidian, copper, and other metals identify quarry sites. Trading sites are identified by large quantities of exotic trade objects and by their strategic position near major cities. The Assyrian market that flourished outside the Hittite city of Kanesh in 1900 B.C. is an example. Art sites, which abound in southwestern France, southern Africa, Australia, California, and other areas, are identified by paintings on the walls of caves and rock shelters.

Cultures, Areas, Regions, and Settlement Patterns

The spatial units we have referred to thus far are all confined to the boundaries of one community. They reflect the activities of the maximum number of people who occupied a settlement at some time during a cycle of settlement. Although a great deal of archaeological research is carried out on single sites, archaeologists often seek to understand the prehistory of a much wider area. Several communities or a scattered population living in a well-defined region may be linked in the same subsistence or settlement system. Such commonly held systems, and the human activities that derive from them, make up an entire culture. Cultural behavior is identified by the patterning that appears in an entire assemblage.

Studying an entire culture involves working with much larger bodies of archaeological information, as well as with background geographic

and environmental data. A number of units commonly subsume such larger-scale information (Willey and Phillips, 1958). Cultures, areas, regions, and settlement patterns are spatial and integrative units that involve chronological, social, and cultural dimensions as well.

Archaeological cultures are consistent patternings of assemblages, the archaeological equivalents of human societies. Archaeological cultures consist of the material remains of human culture preserved at a specific time at several sites.

Culture areas are large geographic areas in which artifacts characteristic of an archaeological culture exist in a precise context of time and space. One can refer to both a Maya cultural system and a Maya culture area.

Archaeological regions are generally described as well-defined geographic areas bounded by conspicuous geographic features, such as an ocean, a lake, or mountains. Once having defined a region geographically, the researcher will try to identify its ecological and cultural boundaries throughout prehistoric times. Most regional approaches involve far more than comparing the artifacts from a few scattered settlements. They are based on a research strategy aimed at sampling the entire region and on objectives intended to reconstruct many more aspects of prehistoric life than those uncovered at a single site. These include both social organization and economic strategies.

A **settlement pattern** is the distribution of sites and human settlement across the natural landscape (see [Chapter 15](#)). Settlement patterns are determined by many factors, including the environment, economic practices, and technological skills. Settlement archaeology is part of the analysis of interactions between people and their environment.

In determining spatial relations, archaeologists base their studies of the behavior of a human society as a whole on models and hypotheses tested by data from many disciplines. These data bear on the ways in which communities and their associated assemblages are grouped into larger units on the landscape. They bear, too, on the ways in which prehistoric societies interacted with the ever-changing natural environment.

Spatial context is vital to scientific archaeology, for it provides one of the critical dimensions of archaeological data. Time, the other critical

dimension, is considered in [Chapter 7](#).

Summary

1. Culture is humanity's primary means of adapting to the environment. Human culture is made up of our behavior and its results; it is also the way in which we assign meaning to our lives. Our culture is always adjusting to both internal and external change.
2. Archaeologists work with the tangible remains of human activity that survive in the ground. Archaeological finds are not culture in themselves but products of it, and they are linked to culture in a systematic way.
3. Archaeologists often think of human cultures as complex systems of interacting variables. This viewpoint is based loosely on principles of general systems theory, a way of searching for general relationships in the empirical world. A major objective of archaeology is to understand the complex linkages between human cultures and the environments in which they are found.
4. Cultural process involves identifying the factors responsible for the direction and nature of change within cultural systems. Processual archaeology is the analysis of the causes behind cultural change.
5. This chapter defined the archaeological record, data, and provenance; discussed the fundamental principles of association and superposition; and examined context in archaeology.

Further Reading

- Deetz, James. 1967. *Invitation to Archaeology*. Garden City, NJ: Natural History Press.
- Price, T. Douglas. 2006. *Principles of Archaeology*. New York: McGraw Hill.
- Wiley, Gordon, and Phillip Phillips. 1958. *Method and Theory in American Archaeology*. Chicago: University of Chicago Press.





- ④ Cat resumes slumber on the carpet

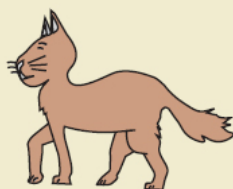


- ③ Papers are pulled out from under cat (who protests)



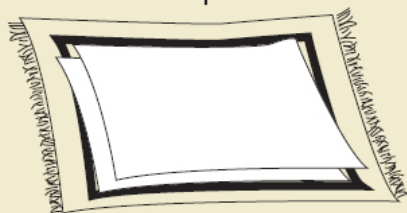
TIME INTERVAL
UNKNOWN

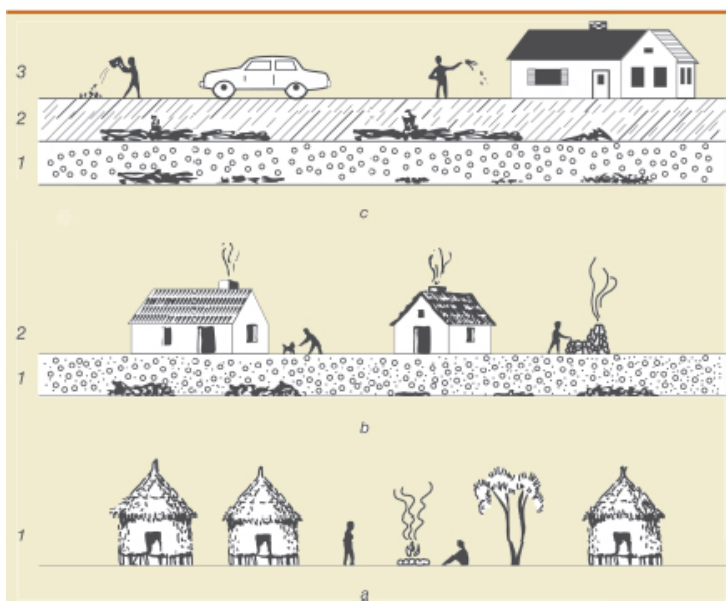
- ② Cat walks onto carpet and sits on the paper



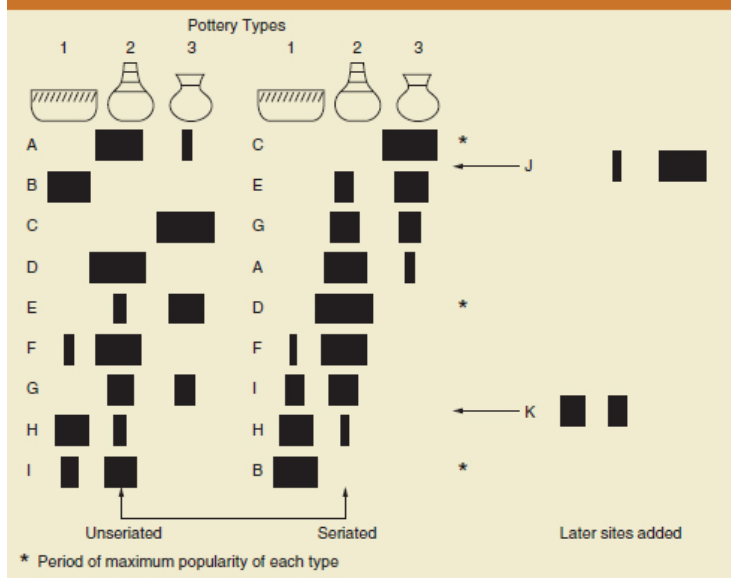
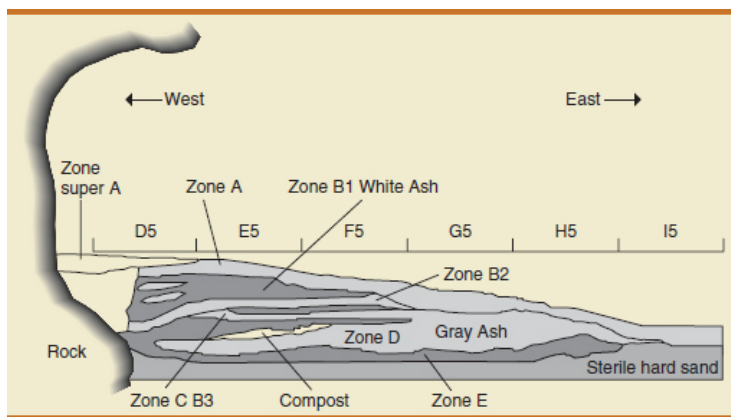
TIME INTERVAL
UNKNOWN

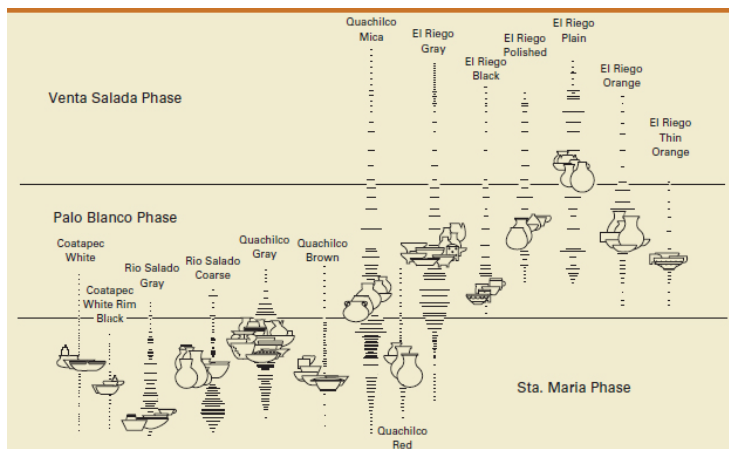
- ① Papers placed on carpet





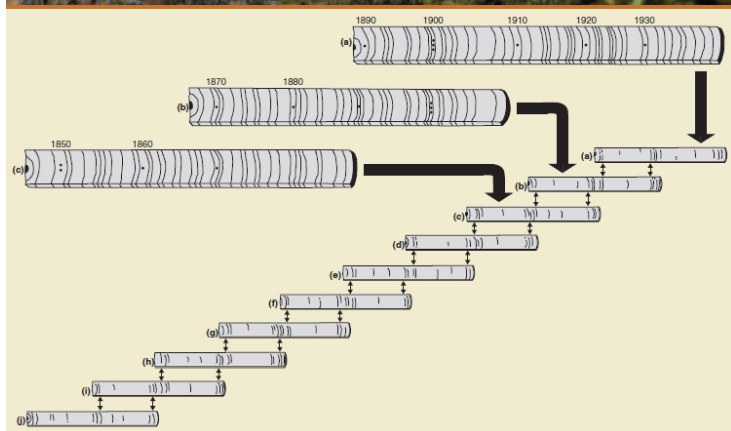
Approximate Age	Geological Epoch	Three-age Terminology	Important Events
3000 B.C. – 7800 B.C. –	HOLOCENE	Iron Age Bronze Age Neolithic Mesolithic	Writing in the Near East Origins of food production
12000 B.C. – 35000 B.P. –	END OF PLEISTOCENE	Upper Paleolithic	Settlement of the Americas Origins of blade technology
70000 B.P. – 400000 B.P. –	PLEISTOCENE	Middle Paleolithic	Appearance of Anatomically Modern Humans (120,000 B.P.) Hand axes in widespread use
1.75 million B.P. – 5 million B.P. –		Lower Paleolithic	Origins of toolmaking (3.3 million B.P.)
13 million B.P. –	PLIOCENE		
25 million B.P. –	MIOCENE		No humans
34 million B.P. –	OLIGOCENE		



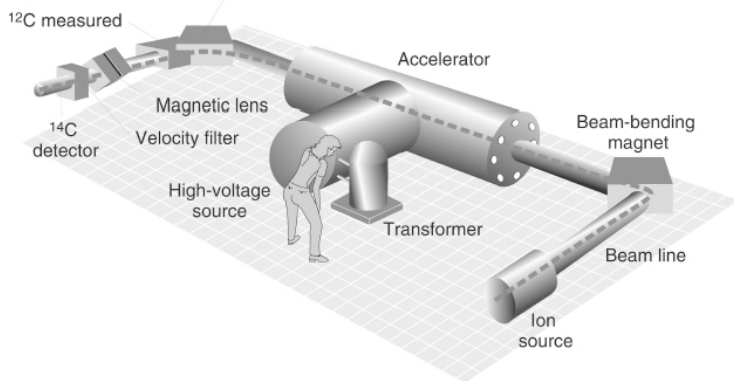


Date	Method	Major developments
Modern times (after A.D. 1)	Historical documents; dendrochronology; imported objects	Columbus in the New World; Roman Empire
2,500 B.C.	Obsidian hydration	Origins of cities Origins of agriculture
10,000 B.C.	TL Radiocarbon dating (organic materials)	Colonization of New World
75,000 B.C.	Uranium	
100,000 B.C.	Potassium-argon dating (volcanic materials)	<i>Homo sapiens sapiens</i>
500,000 B.C.	ESR	
5,000,000 B.C.		Early humans





Beam-bending magnet





7

Dating the Past

CHAPTER OUTLINE

[Cyclical and Linear Time](#)

[Relative Chronology](#)

[Absolute Chronology](#)

The might of Hadrian's Wall, near the borders of England and Scotland, built by the Emperor Hadrian to keep the Scots out of the northernmost Roman province of the empire in the first century A.D.

Source: Courtesy of Shutterstock.

Consider for a moment how you view time. What is the earliest date you can remember? One of us (Brian) remembers his third birthday; he recalls balloons, birthday cake, ice cream, and lots of people. His continuous memory of people as individuals and of day-to-day events

begins at age eight. Remote although it may now seem, his parents saw Queen Victoria in her extreme old age driving in an open carriage in London in 1898. Our collective family history encompasses the twentieth century—over a hundred years. Most adults have a similar span of recollection and have a chronological perspective on their lives extending back into early childhood. Our sense of personal involvement with human history, too, extends only over our lifetimes. We have only partial involvement with the lives of our parents, relatives, or friends, some of whom may have been alive 50 to 70 years before we were born. Perhaps our most profound involvement with time occurs toward the end of our lives, with a period covering the lives of our immediate family. But we also have a marginal sense of longer chronologies and a perspective on events within them—our family ancestry, the history of our community, of our nation, and in these days of ardent internationalism, of the world as well—though few people have a sense of perspective for the whole span of human experience.

The measurement of time and the ordering of cultures in chronological sequence have been one of the archaeologist's major preoccupations since the very beginnings of scientific research (Lucas, 2005). This chapter examines the ways in which archaeologists establish chronological relationships among artifacts, sites, and other features. How does one classify the past and measure the age of the great events of the past?

Cyclical and Linear Time

Westerners think of the passage of the human past as having occurred along a straight, if branching, highway of time. This way of thinking gained popular acceptance in the West during the Enlightenment of the eighteenth century, which incidentally coincided with (or precipitated) the widespread use of the mechanical clock, allowing the highly accurate measurement of time. The great nineteenth-century German statesman Otto von Bismarck called this the “stream of time,” upon which all human societies ride through good times and bad. The analogy is apt, if you think of time in a linear fashion, as archaeologists do. They use a variety of chronological methods to date the millennia of the remote past.

An unfolding, linear past is not the only way of conceptualizing ancient times. Many societies, ancient and modern, think of time as a cyclical phenomenon, or sometimes as a combination of the linear and the cyclical. The cyclical perspective stems from the passage of the seasons and of heavenly bodies, from the close relationships that foragers and village farmers have with their natural environments. It is also based on the eternal realities of human life: fertility, birth, life, growth, and death. The endlessly repeating seasons of planting and harvest, of game movements or salmon runs, and of ripening wild foods governed human existence in deeply significant ways. The ancient Maya developed an elaborate cyclical calendar of interlocking secular and religious calendars to measure the passage of the seasons and to regulate religious ceremonies (Coe and Houston, 2015; Schele and Freidel, 1990).

But we should not assume that societies with cyclical views of time did not have linear chronologies as well. The celebrated Maya “Long Count” was a linear chronology that formed an integral part of the close relationship between Maya rulers and the cosmos. The ancient Egyptians developed a linear chronology for administrative purposes. But in general, societies develop linear chronologies only when they need them. For example, all industrial societies use linear time to regulate times of prayer, to control the working day (and thus its workers), and to determine airline schedules. It is hard to generalize, but societies with centralized political systems tend to use the reigns of chiefs or kings as signposts along a linear timescale (Figure 7.1).

DISCOVERY Human Sacrifice At Teotihuacán, Mexico, 1998

Teotihuacán, on the edge of the Valley of Mexico, had grown from a series of small villages into a huge metropolis with more than 200,000 inhabitants by A.D. 650 (see Figure 15.14 on page 301). A vast ceremonial complex dominated by the Pyramids of the Sun and Moon formed the core of the city, but little is known of the builders or of the rituals once celebrated there. In 1998, a team of American and Mexican archaeologists headed by Saburo Sugiyama excavated into the heart of the Pyramid of the Moon, where they unearthed four stratified substructures and a human burial dated to about A.D. 150 (Sugiyama, 2005). The grave contained more than 150 artifacts that surrounded a

male skeleton: clay vessels, jade artifacts, figurines, fine obsidian (volcanic glass) blades, and jadeite ear ornaments. The skeletons of several hawks and a jaguar, perhaps buried alive in their cages, lay nearby.

At first, Sugiyama and his colleagues thought that they had unearthed the burial of a noble. But the man's hands were bound behind his back and he lay at the edge of what is obviously a much larger burial complex. They believe that he was a sacrificial victim, killed as part of a ceremony to dedicate either a ruler or an important structure. Sugiyama believes that more burials await discovery deeper in the pyramid, including, perhaps, the undisturbed sepulcher of one of Teotihuacán's rulers. Such a discovery would be of the highest importance, as nothing is known of the great city's powerful rulers.

Figure 7.1 Art as history: A brass plaque from Benin city, West Africa, showing an oba (king) with his attendants. These artifacts served as important historical records of royal reigns and genealogy and were stored in the royal palace.

Source: Courtesy of PRAWNS/Alamy Stock Photo.

Relative Chronology

Archaeologists refer to two types of chronology:

1. **Relative chronology** establishes chronological relationships between sites and cultures.
2. **Absolute chronology** (sometimes called chronometric chronology) refers to dates in years.

Brian's black-and-white cat has just come into his study. Bulging with breakfast, he gives a plaintive meow and looks for a patch of sunlight on the carpet. He spots one, just where Brian has laid down a pile of important papers. Thump! With a sigh, he settles down right on top of the documents and passes out blissfully as Brian writes. Time passes, and Brian realizes that he needs one of the articles in the pile under his faithful feline. He debates whether to have a cup of coffee and procrastinate or to disturb the sleeping beast, knowing that there will be angry claws. In the end, writing deadlines prevail. He gently elevates

the cat and slips out the papers. The cat protests halfheartedly and settles down again, as Brian congratulates himself on escaping grievous injury.

The case of the cat and the papers is a good example of stratigraphy in action (see [Figure 7.2](#)). Consider the sequence of events. Brian sits at his computer, consults some documents, and then lays them to one side on the floor. This is the first event in the sequence. Sometime later, the second event takes place: The cat settles on the papers and goes to sleep. More time passes. Brian needs an article in the pile, lifts the cat, and removes the papers. The final act of this stirring drama follows, as the cat settles down again. An outside observer could use the law of superposition (see [Chapter 6](#)) to reconstruct the sequence of events from the earliest (the dropping of papers on the floor) to the latest (the cat's settling down again). However, although the observer can establish the sequence of events relative to one another in time, he or she cannot tell how long a span of time passed from one event to the other. Nor can he or she know the age of the various objects in the pile. For instance, a document compiled in 1970 might lie in a folder under another one containing a letter written ten years earlier.

Relative chronology is a foundation of all archaeological research, a timescale established either by stratigraphic observation or by placing artifacts in chronological order. As we saw in [Chapter 6](#), stratigraphic observation is based on the law of superposition, which states that, in general, the earliest layers lie below later ones ([Figure 7.3](#)). Many ancient settlements, such as long-occupied caves and rock shelters or huge city mounds in southwestern Asia, can contain dozens of occupation levels, sometimes separated by layers of sterile soil.

Stratigraphy and Relative Chronology

Stratigraphic observation can sometimes yield remarkably long cultural sequences, which can be dated by radiocarbon and other methods. Most relative chronology in archaeology has its basis in large- or small-scale stratigraphic observations in archaeological sites of all ages. These were the types of observations that led to the wide acceptance of the Three-Age System in the Old World (see [Chapter 2](#)), and Willey and Phillips's system (1958) of Paleo-Indian, Formative, Classic, and Postclassic in the

Americas (Figure 7.4).

Superposition is fundamental in studying archaeological sites, for many settlements, such as southwestern Asian mounds, Native American villages in the Ohio Valley, or cave sites, contain multilevel occupations whose decipherment is the key to their relative chronology.

Stratigraphy, as applied to archaeological sites, is on a much smaller scale than that of geology (Harris, 1989, 1993). Most archaeological relative chronology employs careful observation of sequences of occupation levels as well as correlation of these with cultural sequences at other sites in the same area. Successive occupation levels may be found at the same spot, as in a cave, fort, or mound site, where many generations of settlers lived within a circumscribed or restricted area (Figure 7.5). In other sites, however, the chronological sequence can be horizontal, as when economic or political conditions dictate regular movement of villages when fields are exhausted or residence rules are modified. In this case, a cultural sequence may be scattered throughout a series of single-level occupation sites over a large area and can be put together only by judicious survey work and careful analysis of the artifacts found in the different sites.

The stratigraphy of a hunter-gatherer camp site is invariably much less complex than that of an ancient city like London, where people lived in houses for a generation or more, then knocked them down and rebuilt on the same spot. They lost beads and ornaments, trampling them into the earth. They laid new floors, a layer of tile or a few centimeters of liquid cattle dung, over earlier living surfaces. Buildings crumble, a flood may demolish them, or a fire may consume an entire city block. People dig graves and storage pits, resurface streets, enlarge temples, and build open plazas. The archaeologist's relative chronology comes from deciphering these kinds of chronological jigsaw puzzles.

Figure 7.2 A case of feline chronology.

Figure 7.3 Superposition and stratigraphy: (a) A farming village flourishes 5,000 years ago. After a time, the village is abandoned and the huts fall into disrepair. Their ruins are covered by accumulating earth and vegetation. (b) After an interval, a second village is built on the same site, with different architectural styles. This village in turn is abandoned; the houses collapse into piles of rubble and are covered by accumulating earth. (c) Twentieth-century people park their

cars on top of both village sites and drop litter and coins that, when uncovered, reveal to the archaeologist that the top layer is modern. An archaeologist digging this site would find that the modern layer is underlain by two prehistoric occupation levels; that square houses were in use in the upper of the two, which is the later (principle of superposition); and that round huts are stratigraphically earlier than the square ones. Therefore, village 1 is earlier than village 2, but when either was occupied or how many years separate village 1 from village 2 cannot be established without additional data.

Figure 7.4 Some common nomenclature of Old World archaeology and geology.

Figure 7.5 An idealized section through Guilá Naquitz Cave, Valley of Oaxaca, Mexico, showing the different occupation zones. Most cave and rock shelter sections are more complex than this one.

The law of association also comes into play, for the artifacts, food remains, and other finds that come from different occupation layers are as vital as the stratigraphy itself. Each layer in a settlement, however massive or however thin, has its associated artifacts, the objects that archaeologists use as chronological indicators and evidence of cultural change. Stratigraphic observation is rarely straightforward (see the Site box, page 108). Some key questions are never far from the observer's mind: Was the site occupied continuously? Was the sequence interrupted by a natural catastrophe such as a flood, or was it abandoned, then reoccupied generations later? Far more is involved than merely observing different layers. Basically, the excavator has to reconstruct both the natural and cultural transformations that have affected the site since it was abandoned.

Natural transformations result from natural phenomena, such as the volcanic eruption that buried Roman Pompeii in A.D. 79 or the earthquake that devastated another Roman town, Kourion, on Cyprus, in A.D. 365 (see [Figure 15.5](#) on page 293). In the case of the Kourion earthquake, excavator David Soren was able to use historical records to identify the exact moment of the earth movement (Soren and James, 1988). The orientation of collapsed roof tiles gave him the general direction of the epicenter, which lay to the southwest of the town in deep water. Both Roman Herculaneum and Pompeii have yielded graphic evidence of the awful destruction wrought by the sudden ash clouds, including casts of fleeing people frantically trying to escape the

ash and fumes (see [Figure 2.1](#) on page 28). In these cases, volcanic ash sealed a precise moment in time, providing unique opportunities for observing life in a city at a single period.

Mudslides, floods, windstorms, and sand dunes can seal off occupation layers from later horizons. At the other end of the spectrum, burrowing animals can tunnel through soft ash layers and transform beautifully stratified layers into confused mazes.

Relative chronology depends on precise, and thorough, observation and interpretation. (There is more on stratigraphic observation in [Chapter 9](#).)

Artifacts and Relative Chronology

Manufactured artifacts of all kinds are the fundamental data that archaeologists use to study past human behavior. Artifacts are reflections of ancient human behavior, so it follows that they change as peoples' technologies, lifeways, and activities shift over the millennia. Consider the simple, sharp-edged flake knives and choppers used by our early ancestors 2.5 million years ago (see [Figure 11.3](#) on page 202). Modern-day experiments have shown that such artifacts were extremely effective for slicing through fresh meat and butchering animals. Compare such tools with the highly sophisticated supercomputers used by banks and credit card companies today. In the final analysis, you could argue that one evolved from the other, but millions upon millions of minor technological and behavioral changes took place along the way as the simple artifacts of yesteryear branched into more and more sophisticated tools for all kinds of specialized purposes. Most changes were small, sometimes almost imperceptible: a more efficient method for sharpening the edge of a stone tool; changes in the lip angle or decoration on a clay bowl, which led ultimately to an entirely different vessel; new alloys such as tin added to copper to make much tougher bronze. Such cumulative changes are an excellent way of establishing relative chronologies.

Sequence dating is now known as **seriation**, a technique for ordering artifacts by their structure and design. Seriation has achieved a high degree of sophistication since the 1920s. **Frequency seriation** employs percentages of artifacts and their features to develop cultural sequences

(Marquardt, 1978).

We live in a world of whirlwind fashions. Chunky 1970s sound systems get reduced down to “slick” personal cassette players. A decade later, even slicker portable CD players are the ultimate accessory, only to be replaced by tiny MP3 players on which the content of all your CDs can be stored. Now most of us aren’t even buying CDs but downloading all of our music from the Web. The miniskirt suddenly descends to midcalf or even the ankle before rising to new heights. Fashions of all kinds are volatile and ever-changing, including cars or the colors of glass beads traded in remote African villages. In contrast, Stone Age hand axes took hundreds of thousands of years to assume more sophisticated shapes. All these changes, dizzyingly fast or mind-numbingly slow, have one thing in common: At some period in time, they enjoyed a brief, or long moment of maximum popularity. All artifact seriations start with this assumption.

In a classic study, two historical archaeologists, Edwin Dethlefsen and James Deetz (1966), set out to verify this assumption against known historical data. They chose dated New England colonial gravestones from Stoneham, Massachusetts, for this purpose. Three decorative styles had come into fashion at different times: death’s heads, cherubs, and urn and willow motifs. Dethlefsen and Deetz recorded the percentages of the three motifs at nine-year intervals from 1720 to 1829. They found that the death’s head was universally popular until 1760, when it began to give way to the cherub. Cherubs enjoyed high fashion until about 1809, when they suddenly went out of favor as the urn and willow became the style of the day. When they plotted the percentages as horizontal bar graphs ([Figure 7.7](#)), they acquired a series of profiles, which looked very much like an old-fashioned battleship seen from above with its thick belt of armor amidships. The “battleship” curves of the Stoneham gravestones followed one upon the other with almost perfect symmetry. This classic and oft-quoted example of changing artifacts illustrates the principle of frequency seriation perfectly. (See the Doing Archaeology box next.)

The so-called battleship curve frequency seriation method is widely used in American archaeology. Let’s say that you have nine excavated archaeological sites, each containing different percentages of different pottery forms. You classify the vessels from each location into three

distinct types with characteristic decoration, calculating the percentages of each in every site. Next, you apply the battleship curve principle, placing the sites in order by placing the horizontally arranged percentage bars in order (Figure 7.6). This arrangement will give you a relative chronology for the sites. Then, later on, you excavate two more settlements, where, again, you calculate the percentages of decorated pots. On the assumption that closely similar artifacts were made at approximately the same time at all sites within a restricted order, you can fit these new percentages into your master sequence and obtain a relative date for the extra sites.

S i T E > 1 Poultry, City of London <

Few archaeological sites have such detailed and complex stratigraphy as those uncovered in the City of London. One of the most remarkable sites, right in the heart of the city, was excavated in the mid-1990s at the address “1 Poultry” (Rowsome, 2000).

Hidden from public view, an archaeological team was working on what would become the basement for new offices. Over the course of two years, they uncovered 2,000 years of occupation—including evidence of the original road, which was some 30 feet (9 m) wide, plus mosaics, timber and stone buildings, and thousands of beautifully preserved coins and pots, among other artifacts. Together, these remains tell the story of London from its earliest occupation as a Roman frontier town to provincial capital, from its revival as medieval Europe’s largest city to recovery from the great fire and plague, to the world’s richest metropolis, on into the Blitz, and the famously disputed demolition of 16 Victorian buildings.

The earliest Roman ground level was up to 23 ft (7 m) below that of today—with overlying layers of human occupation as people put up, and pulled down, or dug pits and dumped rubbish. More recent material would often cut into older levels. To establish the relationship between the different layers, the archaeologists drew up a matrix showing how all the evidence fitted together. Though it was often extremely difficult to understand and interpret the various layers, computer programs allowed the team to compare strata across different sites. Thus, the archaeologists were able to build up a picture of 2,000 years of occupation, from the time of the “first Londoners” to today.

Figure 7.7 shows a classic example of pottery seriation combined with stratigraphic observation from Mexico's Tehuacán Valley, famous for its evidence of early maize farming. Archaeologist Richard MacNeish (1970) worked before radiocarbon dating was a highly refined dating method. He had excavated or surface-collected dozens of stratified and unstratified sites and needed to develop a relative chronology based on changing pottery styles. He used a combination of stratigraphy and seriation of many distinctive pottery types to place three stages of Tehuacán culture in a relative chronology. Notice that MacNeish used no absolute dates to develop this sequence (which has subsequently been confirmed by radiocarbon dating).

Figure 7.6 Seriation: At the left, nine excavated sites (A–I) contain different percentages of three distinct pottery types. At the right, the nine sites have been seriated by rearranging the bars of type percentages into battleship curve order. At the far right, later excavations are eventually fitted into the sequence.

Artifact seriation has obvious limitations and works best when pottery types or other tool forms change predictably over a long period of time. Today's seriators use sophisticated statistical methods to produce the seriation and to test the validity of their conclusions (Dunnell, 1970; Marquardt, 1978).

Figure 7.7 Seriation of pottery styles from the Tehuacán Valley, Mexico, showing many sites ordered into a single sequence. Richard MacNeish classified the different pottery types at each site and then placed them in chronological order on the basis of stratigraphic observations and periods of maximum popularity for each pottery type represented. Here the battleship curve principle is used to develop a sequence of changing pottery forms, with each site being "fitted" into the sequence on the basis of the percentage of each pottery type represented.

Source: From R. S. MacNeish, *The Prehistory of the Tehuacán Valley*, vol. 3. Copyright 1970 University of Texas Press. Reprinted by permission of the Andover Foundation for Archaeological Research.

Absolute Chronology

Many of our most fundamental questions about the past involve chronology (Aitken, 1990; Taylor and Aitken, 1998). How old is this

stone ax? Are these villages contemporaneous? When was this woman buried? Relative chronology is comparatively straightforward compared with actual dating in calendar years. More effort has gone into inventing methods of dating the past than into almost any other aspect of archaeology.

The landscape of the human cultural experience stretches back more than 3 million years into the past. Relative dating allows us to people this landscape with myriad long- and short-lived human cultures ordered in local, regional, and continent-wide sequences. The relatively dated past is like a branching tree, but a tree whose branches and limbs never grew evenly or sprouted at the same time. Relative dating allows us to erect the tree, to plot its boughs and twigs in reasonably accurate order. We have a sense of a changing landscape but no perspective of passing years. Without absolute dates, we do not know the precise dates when humanity originated, when specific cultures began and ended, or how fast they changed. Nor do we have any inkling of when different major developments, such as the changeover from hunting and gathering to farming, took place in the Americas as opposed to southwestern Asia, or in China relative to tropical Africa. Absolute chronology is essential if we are to measure the rates of culture change over long and short periods of time.

Dates in calendar years are the force that causes the stationary body of the past to come alive in the archaeologist's hands. Extremely precise tree-ring dates from the American Southwest tell the story of a prolonged drought cycle that affected the Ancestral Pueblo people in the twelfth century, perhaps causing them to disperse from large pueblos into small villages. Radiocarbon dates calibrated with tree rings from Abu Hureyra, Syria, tell us that people switched from foraging to farming within a remarkably short time, perhaps within a few generations. The colonization of the remotest Polynesian islands unfolded within a mere century or so. We now know that urban civilizations developed first in Egypt and Mesopotamia in about 3100 B.C. , by 2000 B.C. in northern China, and in Central and South America shortly thereafter.

Figure 7.8 shows the chronological span of the major absolute dating methods used to date the immense span of the human past (Wintle, 1996). Let's now work our way back into the remote past, as we

examine these major methods.

Historical Records, Calendars, and Objects of Known Age (Circa 3000 B.C. to Present)

Everyone learns the dates of major events in recent history in elementary school: the date of the Declaration of Independence (A.D. 1776) or the year when Roman general Julius Caesar landed in Britain (55 B.C.). Such years are landmarks that anchor the formation of modern nations, recorded in many documents. Unfortunately, however, written history has a short time span of only about 5,000 years; therefore, it is useful only for dating sites and artifacts from about 3000 B.C. to the present.

Doing Archaeology Flinders Petrie and Sequence Dating

In the 1880s and 1890s, a remarkable Egyptologist named Flinders Petrie (1889) unearthed hundreds of shallow graves in desert cemeteries at Diospolis Parva, close to the Nile River. These villagers had farmed along the river many centuries before the first pharaoh, Narmer (Menes), unified Egypt into a single state in about 3100 B.C. Historical dates in Egypt went back to Narmer, but then petered out. Petrie's "Predynastic" burial subjects wore few ornaments, but they lay with groups of jars, pots, and bowls. Flinders Petrie had an eye for smaller objects. He hit on the brilliant idea of using the groups of clay vessels from the graves to place the graves in chronological order, by arranging the pots so that their stylistic differences reflected gradual design changes. The jar handles were especially informative, for they changed over time from mere ledge-like appendages to more decorative and functional handles before they degenerated into little more than painted lines. Petrie spent months dividing the grave lots into no fewer than 50 stages, which he called "sequence dates." His stages started with SD30, for he rightly assumed that he had not found the earliest Predynastic pottery. SD80 linked the cemeteries to dynastic Egypt in about 3100 B.C.

Flinders Petrie's sequence dates provided an admirable way of placing Predynastic burials and sites throughout the Nile Valley into relative chronological order. Over half a century passed before anyone could provide calendar year dates for Predynastic Egyptian cultures

with radiocarbon dates. The Diospolis Parva graves provided one of the first instances in which artifacts provided a reliable relative chronology.

Historical Records In 1290 B.C. , the Egyptian king Seti I inscribed a king list on the walls of his temple at Abydos by the Nile River. His scribes recorded the names of 75 royal ancestors. His successor, Rameses II, ordered his scribes to prepare yet another complete list of rulers, which survives as the so-called Turin Canon (Kemp, 2006). This remarkable document appears to contain the list of every pharaoh from Rameses back to Narmer (Menes), the first ruler of a unified Egypt in about 3100 B.C. The scribes who compiled the two king lists were less concerned with chronology than with making a political statement about the long continuity and stability of Egyptian civilization since the remotest past. Today, both the Seti list and the Turin document provide Egyptologists with a priceless record of the chronology of ancient Egyptian civilization down to the conquest of the Nile Valley by Alexander the Great in 332 B.C. , a date known from Greek historical records. The accuracy of the dates varies from as little as two decades or so after 1500 B.C. , but as much as two centuries when you work back to earlier reigns.

Figure 7.8 Chronological span of major chronometric methods used in archaeology. The column at the left shows the immense span of prehistory when compared with historic times, illuminated by written documents, which began about 5,000 years ago.

With respect to writing—that is, a system of graphic signs able to express the full range of spoken language and of thought—it emerged in many different cultures of the ancient world at different times (see later). It is probable that some of these emergences were independent inventions, but a single origin for writing is also a possibility (Robinson, 2007). At present, the Sumerians of ancient Mesopotamia are credited with inventing the earliest form of writing, around 3300 B.C. , when there is evidence of a system using over 700 symbols. The earliest symbols were pictorial representations (“pictograms”) inscribed in wet clay, which was then dried. The pictograms soon evolved into stylized symbols in the form of a script known as cuneiform (Greek *cuneus*, “wedge”), because it consisted of crescent-like signs pressed into clay

with the wedge-like end of a reed stylus. However, the Mesopotamian writing “revolution” had a long evolution: as far back as 8000 B.C. , the ancient Mesopotamians used simple clay tokens and other marking systems to record increasingly complex dealings between people living at some distance from one another (Schmandt-Besserat, 1996). Full writing in ancient Egypt seems to have developed slightly later, probably independent of, but perhaps influenced by, Mesopotamian writing. The earliest Egyptian evidence comes from bone tags found in a tomb in Abydos dated around 3200 B.C. (maybe a little earlier); they are inscribed with pictograms that may be precursors of the Egyptian hieroglyphic system (Houston, 2004).

Though the earliest written records were little more than merchants’ transactions and accounts, early scribes soon widened their activities and produced all manner of legal documents, poetry, school texts, and more. Cuneiform scripts of Mesopotamia were eventually used to produce some great literary works, notably the epic of Gilgamesh, which describes a great flood, familiar to us from the Old Testament. Monumental inscriptions, often inscribed onto buildings or monuments, beginning from around 3100 to 3000 B.C. in Egypt and 2600 B.C. Mesopotamia, provide a valuable dating method.

Elsewhere around the world, deciphered historical records provide dates for early eastern Mediterranean civilizations, for Chinese states after 2000 B.C. , and for much of Europe after the Roman occupation just before Christ. However, document-based history came to parts of tropical Africa and Asia only in the late nineteenth century A.D. In the Americas, the Maya developed a complex written script just over 2,000 years ago and an intricate calendar system that provides an accurate chronology for major events in later Mesoamerican history (Schele and Freidel, 1990). Written sources for Native American societies elsewhere begin with European expansion after the fifteenth century.

[Figure 7.9 Reconstructed pillars at the Palace of Minos, Knossos, Crete, with the Royal Guardroom in the background, circa 1450 B.C. The often-fanciful reconstruction of parts of the palace was undertaken by British archaeologist Sir Arthur Evans during the 1920s.](#)

Source: Courtesy of Shutterstock.

Thus, documents provide accurate dates for only a tiny span of human existence, most of it concentrated in the Mediterranean and the Near and Far Eastern Asian worlds. We know the precise date when the Pilgrims settled Plymouth Plantation in Massachusetts and when galleons from the battered Spanish Armada foundered on the rocks of western Ireland. But written history covers but the blink of a chronological eye in the larger landscape of a 3-million-year-old cultural past.

Calendars People maintain calendars for many reasons: to commemorate the dates when rulers ascended to their thrones, to time important festivals, or to mark the passage of the seasons. Few ancient societies developed calendars as elaborate as those of the ancient Mesoamericans. The Maya calendar is justly famous. Once used to regulate the agricultural and religious years, the gear wheel of intersecting sacred and secular calendars organized every aspect of Maya life in repeating cycles (Coe and Houston, 2015). At the same time, their priests maintained a linear calendar known as the Long Count, recorded on stone uprights. Experts have linked this to the Christian calendar and placed its span to be between 3114 B.C. and A.D. 909, although it lasted in places until the Spanish Conquest of the sixteenth century. Much of this timescale unfolded before the Maya themselves lived in organized states, but their unique calendar provides a useful check on the dates of cities such as Copán, Palenque, and Tikal.

Like written documents, ancient calendars cover relatively short time brackets within the past 5,000 years. Nevertheless, they are invaluable for detailed studies of such topics as Aztec or Egyptian civilization.

Objects of Known Age (Cross-Dating) Objects of known age, such as Roman coins or Chinese porcelain, can be used to date archaeological sites hundreds, if not thousands, of miles away from their point of origin. Sir Arthur Evans, who discovered Minoan civilization on the island of Crete in 1900, established the chronology of the Bronze Age Palace of Knossos, home of the legendary King Minos, using cross-dating in reverse (Figure 7.9). He developed an elaborate relative chronology of Minoan painted pottery at the palace, then consulted Egyptologists, who showed him examples of precisely similar vessels

excavated from Egyptian sites dating to before 1500 B.C. Evans anchored Minoan chronology with these historical links, which resulted from an active trade in timber, olive oil, and other commodities between Crete and the Nile Valley. Cross-dating also works with hieroglyphic inscription on Maya post, which can be used to date the structures in which they are found.

Historical archaeologists make extensive use of objects of known age to date sites and structures (Orser, 2016). One of the most useful colonial American artifacts is the imported English kaolin pipe (Figure 7.10). Not only were pipes manufactured, imported, smoked, and thrown away within a very short time but the shape of the pipe body changed in an easily recognizable evolutionary chain. Clay pipes were so cheap that everyone, however poor, used and discarded them almost like cigarettes. Not only the bowl but also the length of the stem and the diameter of the hole changed between A.D. 1620 and 1800. These characteristics have been used to date these artifacts and the sites associated with them with considerable precision.

Figure 7.10 Representative evolutionary changes in the designs of English clay tobacco pipes dating to between A.D. 1730 and 1830.

Source: From Ivor Noël Hume, *Artifacts of Colonial America*. Copyright © 1969 by Ivor Noël Hume. Used by permission of Alfred A. Knopf, a Division of Random House, Inc.

The potential range of historic objects that can be dated to within surprisingly narrow chronological limits is enormous (Orser, 2016). Many people collect beer cans, bottle caps and openers, barbed wire, firearms, uniform buttons, and even horseshoes. All these artifacts, to say nothing of such prosaic objects as forks, electrical switch plates, and scissors, can be dated to within a few years with mail-order catalogs, U.S. patent records, and a great deal of patient detective work. Bottles, buckets, and horseshoes may be the unrespectable artifacts of archaeology, but unlike many of their prehistoric equivalents, they can be dated with great accuracy. What better way to learn about archaeology than to study and date our own material culture!

On a wider ancient canvas, **cross-dating** can be used from about 3000 B.C. to the present, using objects of known historical age to date

archaeological sites found far from the known objects' place of origin. Objects such as Chinese porcelain, Roman glass, cotton and flax fabrics, bronze daggers, and Greek amphorae traveled far from their homelands in the Old World. European coins and medals sometimes passed deep into the American interior along well-established trade routes. Such objects provide chronological horizons for dating hitherto undated pottery styles and other artifacts in remote areas such as, for example, western Europe during the Iron Age, after 1000 B.C.

Cross-dating is also effective when you can date a single long cultural sequence comprising numerous archaeological sites using seriated artifacts, then date the same sites and artifact forms with blocks of tree-ring or radiocarbon dates. You can then extrapolate the master chronology to nearby sites in the same region by seriating distinctive artifact types and matching them to the master sequence. Richard MacNeish (1970) used this approach with great success in Mexico's Tehuacán Valley, as have many other researchers in North America.

Tree-Ring Chronology (10,000 Years Ago to Present)

Everyone is familiar with tree rings—concentric circles, each circle representing annual growth—visible in the cross section of a felled tree's trunk. All trees form such rings, but they are better defined when the tree grows in an environment with well-marked seasons (winter and summer temperatures or dry and wet months). In about 1913, Arizona astronomer Andrew E. Douglass started counting tree rings as a way of dating sunspot activity. He soon realized the potential of **dendrochronology**, a method of using tree rings to date ancient Southwestern pueblos (Speer, 2010). At first he developed two tree-ring sequences. One was based on slow-growing and long-lived sequoias and California bristlecone pines; the latter eventually provided a chronology of 8,200 years. His second sequence used ancient, long-dead trunks, many of them pueblo door lintels and beams. Douglass was unable to link his "floating" chronology of pueblo beams to his master sequence until 1929, when he located the missing few years in a beam from Show Low, Arizona. Since then, Southwestern archaeologists have enjoyed a remarkably accurate chronology, so precise that it can date

not only entire pueblos but also, sometimes, individual rooms within them. The principles of tree-ring dating are discussed in the Doing Archaeology box on page 114.

S i T E > Cross-Dating at Great Zimbabwe, Central Africa <

A classic example of cross-dating comes from Central Africa. Back in 1929, intrepid British archaeologist Gertrude Caton-Thompson found herself confronted by a first-rate archaeological mystery. Great Zimbabwe was a complex of freestanding stone ruins clustered below a low hill where the ancient builders had erected stone-walled enclosures high above the valley floor ([Figure 7.11](#)).

The high granite walls of the oval Great Enclosure, adorned with a chevron pattern and an enigmatic conical tower, dwarfed the diminutive Caton-Thompson, who had never seen anything like them before. Great Zimbabwe was unique and was such a sophisticated structure that early European archaeologists who ransacked the buildings for treasure refused to believe that they had been built by black Africans. Caton-Thompson searched for patches of undisturbed occupation deposits missed by earlier excavators and sunk carefully placed stratigraphic trenches in the hilltop enclosures and in the Great Enclosure. Almost at once, she discovered fragments of imported Chinese porcelain, which had reached Zimbabwe in the hands of traders from the distant Indian Ocean coast. From her researches in Egypt and elsewhere, she knew that experts could date Chinese porcelain within remarkably narrow chronological limits in their places of origin. She sent the porcelain to London's Victoria and Albert Museum, where specialists in Chinese artifacts assigned her imported potsherds to the Ming dynasty, specifically to the fourteenth and early fifteenth centuries A.D.

The Chinese porcelain provided Caton-Thompson with a solid cross-date from China to Africa, thereby placing the heyday of Great Zimbabwe between A.D. 1350 and 1450. She concluded that indigenous Africans had built the stone structures. Although radiocarbon dates have refined Caton-Thompson's chronology, no scientist has challenged her cross-dating (Garlake, 1973).

Figure 7.11 The Great Enclosure, Great Zimbabwe, Zimbabwe.

Doing Archaeology The Principles of Tree-Ring Dating

As a rule, trees produce growth rings each year, formed by the cambium, or growth layer, lying between the wood and the bark. When the growing season starts, large cells are added to the wood. These cells develop thicker walls and become smaller as the growing season progresses; by the end of the growth season, cell production has ceased altogether. This process occurs every growing year, and a distinct line is formed between the wood of the previous season, with its small cells, and the wood of the next, with its new, large cells. The thickness of the rings may vary according to the tree's age and annual climatic variations; thick rings are characteristic of good growth years.

Weather variations within a circumscribed area tend to run in cycles. A decade of wet years may be followed by five dry decades. One season may break a 40-year rainfall record. These cycles of climate are reflected in patterns of thicker or thinner tree rings, which are repeated from tree to tree within a limited area. Dendrochronologists have invented sophisticated methods of correlating rings from different trees so that they can build up long master sequences of rings from a number of trunks that may extend over many centuries.

Samples are normally collected by cutting a full cross section from an old beam no longer in a structure either by using a special core borer to obtain samples from beams still in a building or by V-cutting exceptionally large logs. Delicate or brittle samples are impregnated with paraffin or coated with shellac before examination.

In the laboratory, the surface of the sample is leveled to a precise plane. Analyzing tree rings consists of recording individual ring series and then comparing them against other series. Comparisons can be made by eye or by plotting the rings on a uniform scale so that one series can be compared with another. The series so plotted can then be computer-matched with the master tree-ring chronology for the region ([Figure 7.12](#)).

Tree-ring dating has two limitations. It can only be used on trees outside the tropics, where the differences between seasons are significant. Furthermore, it is only effective for chronological use if the

trees being used have developed a long master sequence linked to today's living trees. Such a sequence can then be matched to "floating" sequences.

It's also important to realize that a tree-ring date gives you the date when the tree was felled. To find this, you have to match the outermost (latest ring, the so-called sapwood) to the regional master sequence. If you can identify the sapwood and felling date, you then have to establish how long a period of time elapsed between the felling and the moment when the timber was incorporated into, say, a pueblo or house as a beam.

In other words, dendrochronology is not as easy as it looks!

Figure 7.12 Building a tree-ring chronology: (a) Boring taken from a living tree after the 1939 growing season. (b–j) Specimens taken from old houses and progressively older ruins. The ring patterns match and overlap back into the past.

Source: Adapted from D. R. Brothwell and Eric Higgs, eds. *Science in Archaeology*. London: Thames and Hudson, 1961.

Extremely accurate chronologies for Southwestern sites come from correlating a master tree-ring sequence from felled trees and dated structures with beams from Indian pueblos. The beams in many such structures have been used again and again, and thus some are very much older than the houses in which they were most recently used. The earliest tree rings obtained from such settlements date to the first century B.C. , but most timbers were in use between A.D. 1000 and historic times.

In one classic example, Jeffrey Dean (1970) collected numerous samples from wooden beams at Betatakin, a cliff dwelling in northeastern Arizona dating to A.D. 1270. He used 292 samples to reconstruct the history of the cliff dwelling, room by room. He found that three room clusters were built in 1267 and a fourth was added a year later. In 1269, the inhabitants trimmed and stockpiled beams for later use, which were not used until 1275, when ten more room clusters were added. Such intrasite datings are possible when a large number of samples can be found. Similar research at Walpi Pueblo, a Hopi site in Arizona founded in A.D. 1400 and still inhabited today, proved the

essential validity of Dean's methods but also highlighted the difficulties of dating complex sites where beams are reused frequently, as when salvaged beams have been trimmed and reused (Ahlstrom et al., 1991).

Use of dendrochronology was once confined to the American Southwest but is now widely used in many other parts of the world, including Alaska, Canada, parts of the eastern United States, England, Ireland, continental Europe, the Aegean Islands, and the eastern Mediterranean (Kuniholm, 2001; Manning and Bruce, 2009). The Europeans have worked with oak trees with ages of 150 years or more to develop master chronologies for recent times. Using visual and statistical comparisons, they have managed to link living trees to dead specimens serving as church and farmhouse beams and others found well preserved in bogs and waterlogged peats or prehistoric sites. The resulting tree-ring sequences go back at least 10,021 years in Germany and 7,289 years in Ireland. The Aegean Dendrochronology Project has developed a tree-ring sequence covering 6,000 of the last 8,500 years, which is leading to much more precise dates for the Minoan and Mycenaean civilizations than those suggested by cross-dating or radiocarbon readings. So precise are the master sequences that an expert can date even short ring cycles to within a few years. Art historians even use tree rings to date the oak boards used by Dutch old masters as a means of authenticating paintings. And two British scholars used tree rings from a Stradivarius violin known as "the Messiah," thought to be a forgery, to show that it was made in about 1716 and from the same batch of spruce as two other Stradivarius instruments (Topham and McCormick, 2000).

Tree-ring chronologies have far wider importance than merely dating the past. They can provide records of short-term climatic change in areas such as the American Southwest, where cycles of wetter and drier weather can cause radical changes in settlement patterns. Southwestern chronologies are accurate to within a year, a level of accuracy rarely achieved with archaeological chronologies anywhere. In recent years, the Laboratory of Tree Ring Research at the University of Arizona has used tree-rings to reconstruct climatic variability in the Southwest from A.D. 680 to 1970. By mapping decade-long tree-ring sequences like contour maps, experts can correlate vacated large and small pueblos with short-term climatic fluctuations (see the Doing Archaeology box

on page 240 in [Chapter 12](#)). Tree-ring sequences are also used to calibrate radiocarbon dates (see the next section).

Radiocarbon Dating (50,000 Years Ago to A.D. 1500)

In 1949, University of Chicago scientist Willard Libby (1955) revolutionized archaeology with the **radiocarbon dating** method of dating wood, bone, and other organic materials up to 50,000 years old. Libby's discovery was a direct offshoot of the development of the atomic bomb during World War II (Taylor and Bar-Yosef, 2013). At first, he tested his new method against organic objects of known historical age, such as Egyptian mummies, but he soon started dating archaeological sites that had been occupied thousands of years earlier. Today, radiocarbon dating based on **accelerator mass spectrometry (AMS)** allows the dating of objects as tiny as a fleck of charcoal inside a tool socket or an individual seed from an early farming village (Pettit, 2005). Thanks to AMS radiocarbon dating, we know that farming first began in southwestern Asia in about 8,800 radiocarbon years B.C. —and we have the dated seeds to prove it. And calibrations based on tree rings, corals, and geological phenomena such as icebergs convert these radiocarbon ages into calendar chronologies, in the case of agriculture about 10,000 B.C.

Radiocarbon dating is the most widely used dating method for dating the past from 50,000 years ago until A.D. 1500, and it provides a global radiocarbon chronology for world prehistory and the late Ice Age. It enables us to measure rates of culture change in different regions of the world and to compare the chronology of such major developments as the first farming or the development of urban civilization in widely separated locations (Barker, 2006). The principles of radiocarbon dating are discussed in the Doing Archaeology box on page 117.

Libby made a false assumption when he originally formulated the radiocarbon method. He had argued that the concentration of radiocarbon in the atmosphere remained constant as time passed, so that prehistoric samples, when alive, would have contained the same amount of radiocarbon as living things today. In fact, changes in the strength of the earth's magnetic field and alterations in solar activity have considerably varied the concentration of radiocarbon in the

atmosphere and in living things. For example, samples of 6,000 years ago were exposed to a much higher concentration than are living things today. It is possible, fortunately, to correct radiocarbon dates by using accurate dates from tree rings dating to between about 12,500 years ago and A.D. 1950 (Reimer et al., 2004). The discrepancies between radiocarbon and calibrated dates are wide. Here is an example: A radiocarbon age of 1,007 radiocarbon years B.C. is a calibrated date of 1267 B.P. (standard deviations are omitted here). Radiocarbon ages around 10000 B.P. may be as much as 2,000 years too young. A date of 6050 B.C. , may in fact be one of 5000 B.C. Calibrated dates can be obtained from several web outlets, such as CalPal-online.de, calib.org/calib, or the Oxford University laboratory: c14.arch.ox.ac.uk/calibration.html.

Radiocarbon experts are now working with researchers dating coral to calibrate even earlier readings. Uranium-thorium dated fossil coral near Barbados in the Caribbean and other deposits in the South Pacific provide calibrations that go back as far as 50,000 years ago. Even earlier calibrations using ice cores are subject to many variables, but one day in the near future it will be possible to correct radiocarbon dates through the whole range of the 50,000 years.

In the early days of radiocarbon dating, the carbon-14 laboratory required as much as a handful of charcoal or other organic material for a single date. Today, AMS allows radiocarbon dating to be carried out by direct counting of carbon-14 atoms (see [Figure 7.13](#)). Accelerator dating distinguishes between carbon-14 and carbon-12 and other isotopes through their mass and energy characteristics, requiring only tiny organic samples such as a seed to do so. The samples needed are so small that it is possible, for example, to date an individual tree ring, a plant fragment, or an artifact. This technology has enabled archaeologists such as Bruce Smith (1992) and Andrew Moore (2000) to date single maize cobs or wheat seed fragments, which obviously give far more accurate dates for such developments as the origins of agriculture than samples that reflect a whole occupation layer do. A new generation of research using Bayesian statistics and meticulous site records, as well as powerful computers, is producing dates of even greater accuracy (see the People of the Past box on page 118). For example, a meticulous study of over 1,400 dates from archaeological

sites in Polynesia has shown that canoes settled all the islands in the Central and Eastern Pacific, including Hawaii and Rapa Nui (Easter Island) within a century or so after A.D. 1000 (Hunt and Lipo, 2011).

Figure 7.13 Accelerator mass spectrometry (AMS) radiocarbon dating. Ionized carbon atoms from the sample are first pulled in beam form toward the accelerator. As the beam passes through the first beam-bending magnet, lighter atoms turn more sharply than heavier ones. They move to the inside of the diverging beam, where a filter blocks the further progress of all charged particles except those of atomic mass 14. When the beam enters the accelerator, it is stripped of all molecules of mass 14 that might be indistinguishable from single carbon-14 atoms. The accelerator pushes the remaining ions through a second beam-bending magnet, filtering out more non-carbon-14 particles. Then the beam is focused before reaching an extremely sensitive detector that counts the number of remaining ions.

Doing Archaeology The Principles of Radiocarbon Dating

The radiocarbon dating method is based on the fact that cosmic radiation produces neutrons that enter the earth's atmosphere and react with nitrogen. They produce carbon-14, a carbon isotope with eight rather than the usual six neutrons in the nucleus. With these additional neutrons, the nucleus is unstable and is subject to gradual radioactive decay. Willard Libby calculated that it took 5,568 years for half the carbon-14 in any sample to decay, its so-called half-life. (The **half-life** is now more accurately measured to be 5,730 years.) He found that the neutrons emitted radioactive particles when they left the nucleus, and he arrived at a method for counting the number of emissions in a gram of carbon.

Carbon-14 is believed to behave exactly like ordinary carbon from a chemical standpoint, and together with ordinary carbon it enters into the carbon dioxide of the atmosphere. The rate of the process corresponds to the rates of supply and disintegration. Because living vegetation builds up its own organic matter through photosynthesis and by using atmospheric carbon dioxide, the proportion of radiocarbon present in it is equal to that in the atmosphere. As soon as an organism dies, no further radiocarbon is incorporated into it. The radiocarbon present in the dead organism will continue to disintegrate

slowly, so that after 5,730 years only half the original amount will be left; after about 11,100 years, only a quarter; and so on. Thus, if you measure the rate of disintegration of carbon-14 relative to nitrogen, you can get an idea of the age of the specimen being measured. The initial amount of radiocarbon in a sample is so small that the limit of detectability is soon reached. Samples older than 50,000 years contain only minuscule quantities of carbon-14.

A date received from a radiocarbon dating laboratory for a particular sample would be in this form: $3,621 \pm 180$ radiocarbon years before the present B.P. (B.P. , as previously noted, stands for “Before Present,” with the present set, rather clumsily, at A.D. 1950—the time that Libby was working. A shame no one had the foresight to pick A.D. 2000 for “the present”—how much easier that would have been for calculations!). The figure 3,621 is the probable statistical age of the sample (in radiocarbon years) before the present (the present being A.D. 1950). Notice that the sample reads in radiocarbon years, not calendar years. Corrections from tree rings must be applied to make this a chronometric date.

The radiocarbon age has the reading ± 180 attached to it. This is the standard deviation, an estimate of the amount of probable error. The figure 180 years is an estimate of the 360-year range within which the date falls. Statistical theory provides that there is a two out of three chance that the correct date is within the span of one standard deviation (3,441 and 3,801). If we double the deviation, chances are 19 out of 20 that the span (3,261 and 3,981) is correct. Most dates in this book are derived from carbon-14-dated samples and should be recognized for what they are—statistical approximations.

Interpreting radiocarbon samples requires eliminating potential sources of contamination before and during sampling, as well as from inadequate documentation of the context in the ground. For example, a burning house beam may have been set alight long after the dwelling was built. The best defense is to date not one sample, but as many as possible, then treat them statistically.

Radiocarbon dating is priceless because it is a universal way of dating sites as far apart as Greenland, New Zealand, South America, and tropical Africa. It provides us with a universal chronology for the human past from about 50,000 years ago until the last 400 years, when its accuracy is too imprecise. Carbon-14 dates are useful for dating the

all-important developments of the late Ice Age and more recent times. Earlier prehistory is far harder to date because of the large periods of time involved and the lack of reliable dating methods that cover much of the Ice Age.

Potassium-Argon Dating (Earliest Times to Circa 500,000 Years Ago)

The only viable means of chronometrically dating the earliest archaeological sites is the potassium-argon dating method (Dalrymple and Lamphere, 1970). Geologists use this radioactive counting technique to date the age of the earth from rocks up to 2 billion years old and as recent as 50,000 years old.

Fortunately, many early human settlements in the Old World are found in volcanic areas, where such deposits as lava flows and tuffs are found in profusion. The first archaeological date obtained from this method came from Olduvai Gorge, Tanzania, where Louis and Mary Leakey found a robust australopithecine skull (*Australopithecus boisei*), stone tools, and animal bones in a lake bed of unknown age. Lava samples from the site were dated to about 1.75 million years, doubling the then-assumed date for early humans (Tobias, 1971). Stone flakes and chopping tools of undoubted human manufacture have come from Koobi Fora in northern Kenya, potassium dated to about 2.6 million years, the earliest date for human artifacts. Still earlier hominin fossils have been dated to about 4.5 million years ago by the same method at Aramis near the Hadar in Ethiopia. A team of Berkeley scientists have dated *Homo erectus*—bearing levels at Modjokerto in southeastern Asia to 1.8 million years using a laser fusion technique (Swisher et al., 1994). It has been used successfully to date human fossils dating to as early as 800,000 years ago, or earlier in the Sierra de Atapuerca in northern Spain.

People of the Past A New Radiocarbon Revolution and the People of the English Long Barrows

A new radiocarbon revolution is transforming our understanding of England's Early Neolithic. Until very recently, prehistory was dominated by processes rather than events. Generally, the Neolithic

was seen in terms of the *longue durée*, a slow and gradual time with vague date ranges and devoid of sudden events and sharp breaks. The problem has always been the fuzziness of traditional radiocarbon dates.

Thus, British long barrow tombs were vaguely dated between 4000 and 3000 B.C. Different phases of construction work were attributed to successive generations. The jumbles of disarticulated bone found scattered in chambers and passageways conjured images of communal mausolea, in use for many centuries, where people engaged in complex rituals of ancestor-worship involving the movement back and forth of ancient bone. Enter stage left, the academic bombshell that is the third radiocarbon revolution.

As we have seen, a second “radiocarbon revolution” occurred when it was realized that atmospheric carbon had varied over time, so that it was necessary to “calibrate” radiocarbon dates by comparing them with tree-ring chronologies. Yet regardless of calibration, there remained a wide margin of statistical error in all radiocarbon dates. The result was a vague prehistory rather than a sequence of discrete events.

But in the last decade, a “third radiocarbon revolution” has taken place. A group of archaeologists, working with English Heritage’s Scientific Team, has created a startlingly accurate new chronology to replace the vague timescales of only a few years ago (Bayliss and Whittle, 2007).

Their work on five Early Neolithic long barrows has revealed the extraordinary potential of a new approach that combines Bayesian statistical methods and the processing power of modern computers. It all hinges on a 250-year-old mathematical formula concerned with “inverse probability”: $(\text{Probability of A}) \times (\text{Probability of B given A}) = \text{Probability of A and B}$. Given an archaeological sequence in which relative chronological relationships are known and a series of radiocarbon dates obtained, Bayesian statistics involve creating a mathematical relationship between the probabilities for each radiocarbon date and those of every other date within the sequence. This allows any particular date to be constrained and “squeezed” by all the other probabilities in the sequence. The program is repeatedly rerun with newly squeezed dates, meaning that centuries can become decades and specific events suddenly punctuate the *longue durée* of prehistory.

The new dating for the construction, use, and abandonment of West

Kennett long barrow, for example, involved 31 separate radiocarbon dates, 30 million separate calculations, and 11 hours of computer processing. But it is now known that the sequence of around 40 interments of men, women, and children probably began in the 3640s B.C. and ended within a mere 30 years! Comparable results have been obtained for Wayland's Smithy I (Figure 7.14), Ascott-under-Wychwood, Fussell's Lodge, and Hazleton North: the barrows were in use for three or four generations at the most, and in one case at least all 14 interments may represent a single mass burial (Bayliss and Whittle, 2007).

The old (and rather imaginative) ideas about the ritual manipulation of ancient bones and complex ancestor worship now look rather unlikely. Since a long barrow was in use for such a short period, the buried people were probably known to the living, rather than some very ancient ancestors. Moreover, the new work indicates that long-barrow burial as a whole may have been a relatively brief fashion. Four of the five barrows studied went out of use around 3625 cal B.C. But each one ended in a different way. At Ascott-under-Wychwood the entrances were blocked. At Fussell's Lodge the timber chamber was consumed by fire. At Hazleton North burial ended but people kept returning to place offerings in passages. And at West Kennett, burial just stopped and people went away. The Early Neolithic has suddenly become dynamic, with geographical diversity, rapid change, and sharply defined events.

Figure 7.14 Wayland's Smithy long barrow as it appears today.

Source: Courtesy of Stephen Dorey/Alamy Stock Photo.

Thanks to this new work, the Neolithic is now running on a rollercoaster of new dates and looks very much more episodic and dynamic. Other research is also revealing that it may have been more violent and dangerous than previously thought. For example, as well as four Early Neolithic sites with clear evidence for some sort of armed clash—Carn Brea, Crickley Hill, Hambledon Hill, and Hembury—an ever-increasing number of burials seem to have evidence for violent death, often detected through the careful reexamination of old excavation records and conserved human bone from barrows. Thus, at

least 136 Early or Middle Neolithic burials are associated with leaf-shaped arrowheads. Though traditionally interpreted as ritual offerings, one or two are embedded in bone, and more still were found in close association with skeletal evidence. Likewise of 350 Early Neolithic skulls to be examined, 2 percent show fatal injury while 4–5 percent show healed injury, many of which appear to be the result of blows by blunt instruments such as clubs and hand-thrown stones.

Were long barrows attempts to substantiate claims to territory in an increasingly divided and competitive world? Were they short-lived because the communities they served were unstable, and did not endure? Were they built at a time of economic, environmental, and or political stress in the first half of the thirty-seventh century B.C. ? Or should we accept that occasional violence is endemic throughout the past, breaking out in different places at different times, but only now clearly recognizable at this time?

The new chronology has its critics, but these new statistics-driven and computer-aided dates are far more accurate than earlier time scales and are giving us a whole new perspective on the ancient east.

Other Absolute Dating Methods

Accurate dating of the past remains one of the greatest challenges of archaeology, partly because of the enormous timescales involved, but also because each archaeological site is unique and so many stratigraphic and other variables affect the formation of archaeological deposits (Pike and Pettit, 2005). The specialist literature is full of well-established dating methods and still-experimental approaches that are destined to become part of the archaeologist's tool kit or vanish into scientific oblivion (Aitken, 1990). The following are some of the more common dating methods in use.

Uranium Series Dating This dating method measures the steady decay of uranium into various daughter elements inside any formation made up of calcium carbonates, such as limestone or cave stalactites. Since many early human groups made use of limestone caves and rock shelters, bones and artifacts embedded in calcium carbonate layers can sometimes be dated by this method, using techniques somewhat similar to those used in radiocarbon dating. **Uranium series dating** is most

effective when applied to sites between 50,000 and a million years old (Shreeve, 1992). There are three decay series: the thorium series, the uranium series, and the actinium series. Uranium series dates are more relevant to geological deposits. Calcium carbonate deposits in caves and rock shelters (speleothem) precipitate from cave drip water, which contains U isotopes but little or no daughter isotopes. As the parent isotopes decay, the daughter isotopes, such as thorium, build up if the system is a closed one. Where archaeological deposits lie between flow stones in caves, one can date them, as was the case at the French cave of La Chaise de Vouthon, where a Neanderthal occupation was dated to between 98,000 and 102,000 years ago. Other speleothem dates include a reading of more than 400,000 years ago for a flow stone overlying the two youngest *H. erectus* fossils at Zhoukoudian Cave, China (Shen et al., 2001).

Fission-Track Dating Many minerals and natural glasses, such as obsidian, contain tiny quantities of uranium that undergo slow, spontaneous decay (Fleischer, 1975). The age of any mineral containing uranium can be obtained by measuring the amount of uranium in the sample. This measurement is done by counting the fission tracks in the material, which are narrow trails of damage in the sample caused by the fragmentation of massive, energy-charged particles. The older the sample, the more tracks it has. Volcanic rocks, such as are commonplace at Olduvai Gorge and other early human sites, are ideal for **fission-track dating**. The volcanic level under the earliest hominin sites at Olduvai has been fission-track dated to 2.03 ± 0.28 million years, which agrees well with potassium-argon dates from the same location.

Thermoluminescence Dating This method is based on the fact that every material on earth receives a low level of radiation from the radioactive elements in the environment (Aitken, 1984, 1990). Many solid materials store small fractions of this energy, which accumulates steadily over time. When the solid is heated, the stored energy is released and emits light, a phenomenon called thermoluminescence. The age of the sample is assumed to be the length of time since the object was heated to a very high temperature. **Thermoluminescence dating** has obvious applications for dating volcanic rocks and other

geological formations, but it can also be applied to humanly heated objects such as clay vessels, heat-treated stone artifacts, or fired bricks.

Samples are taken by crumbling an object such as a potsherd or by drilling tiny holes in it for core samples. The laboratory measures the natural thermoluminescence of the object with an alpha radiation counter, the rate at which the sample has been obtaining radiation from the environment (by monitoring the location where it was found), and the amount of thermoluminescence produced by known amounts of radiation. All this assumes that human-manufactured objects were heated to a sufficiently high temperature originally, which is not always the case.

Thermoluminescence dating is claimed to have an accuracy of 67 percent and is most commonly used to date pottery or clay-fired objects between 50 and about 20,000 years old. Thermoluminescence dates have also been applied to burnt flint and other siliceous toolmaking materials found in Stone Age rock shelters and burials, such as early Australian rock shelters, and to Neanderthal graves in Israel, which date to more than 40,000 years ago. A related dating method uses laser technology to date the emissions from quartz and feldspar grains in archaeological layers. This optically stimulated luminescence (OSL) method can date sites in the 100- to 100,000-year range and is claimed to date the first settlement of Australia to as early as 60,000 years ago.

Doing Archaeology The Principles of Potassium-Argon Dating

Potassium (K) is one of the most abundant elements in the earth's crust and is present in nearly every mineral. In its natural form, potassium contains a small proportion of radioactive potassium-40 atoms. For every 100 potassium-40 atoms that decay, 11 become argon-40, an inactive gas that can easily escape from material by diffusion when lava and igneous rocks are formed. As volcanic rock forms through crystallization, the concentration of argon-40 drops to almost nothing. But regular and reasonable decay of potassium-40 will continue, with a half-life of 1.3 billion years. It is possible, then, to measure with a spectrometer the concentration of argon-40 that has accumulated since the rock formed. Because many archaeological sites were occupied

during a period when extensive volcanic activity occurred, especially in East Africa, it is possible to date them by associations of lava with human settlements.

Potassium-argon dates have been obtained from many igneous minerals, of which the most resistant to later argon diffusion are biotite, muscovite, and sanidine. Microscopic examination of the rock sample is essential to eliminate the possibility of contamination by recrystallization and other processes. The samples are processed by crushing the rock, concentrating it, and treating it with hydrofluoric acid to remove any atmospheric argon from the sample. The various gases are then removed from the sample and the argon gas is isolated and subjected to mass spectrographic analysis. The age of the sample is then calculated using the argon-40 and potassium-40 content and a standard formula. The resulting date is quoted with a large standard deviation—for early Pleistocene sites, on the order of a quarter of a million years.

In recent years, computerized argon laser fusion has become the technique of choice. By steering a laser beam over a single irradiated grain of volcanic ash (feldspar), a potassium-argon specialist can date a lake bed layer or even a small scattering of tools and animal bones left by an early hominin. The grain glows white hot and gives up a gas, which is purified, then charged by an electron beam. A powerful magnet accelerates the charged gas and hurls it against a device that counts its argon atoms. By measuring the relative amounts of two isotopes of the element, researchers can calculate the amount of time that has elapsed since the lava cooled and the crystals formed.

Thermoluminescence sometimes provides absolute dates, but it is more often used to produce relative readings that allow archaeologists to establish whether a clay vessel is actually of the same relative age as the known age of similar pots—a useful approach for unmasking forgeries. Although thermoluminescence has been used to date such developments as the appearance of anatomically modern humans in southwestern Asia and early Australian colonization, most authorities agree that independent verification from radiocarbon or other approaches is advisable.

Electronic Spin Resonance Dating This technique measures

radiation-induced defects or the density of trapped electrons within a bone or shell sample without the need to heat them. This promising dating method is somewhat similar to thermoluminescence dating and has the advantage of being nondestructive. It is especially effective on tooth enamel and bone, allowing investigators to date fossil fragments up to about a million years old. **Electronic spin resonance dating** has important applications for the study of early human evolution and has been used to date the Hoxne site in eastern England, made famous by John Frere in 1797 (see [Chapter 2](#)), to $319,000 \pm 38,000$ years.

Archaeomagnetic Dating We know that the direction and intensity of the earth's magnetic field have varied throughout ancient times. Many clays and clay soils contain magnetic minerals, which when heated to a dull red heat will assume the direction and intensity of the earth's magnetic field at the moment of heating. Thus, if the changes in the earth's magnetic field have been recorded over centuries or even millennia, it is possible to date any suitable sample of clay material known to have been heated by correlating the **thermoremanent magnetism** of the heated clay with records of the earth's magnetic field (Wolfman, 1984). Archaeologists frequently discover structures with well-baked clay floors—ovens, kilns, and iron-smelting furnaces, to name only a few—whose burned clay can be used for **archaeomagnetic dating**. Of course, reheated clays (clays used again after their original heating) will change their magnetic readings and are thus useless for archaeomagnetic dating.

Thermoremanent magnetism (the alignment of magnetic particles fixed by heating) results from the ferromagnetism of magnetite and hematite, minerals found in significant quantities in most soils. When the soil containing these minerals is heated, the magnetic particles in magnetite and hematite change from a random alignment to one that conforms with that of the earth's magnetic field. In effect, the heated lump of clay becomes a very weak magnet that can be measured by a parastatic magnetometer. A record of the magnetic declination and dip similar to that of the earth's actual magnetic field at the time of heating is preserved in the clay lump. An absolute date for the sample can then be obtained if the long-term, or secular, variation of the earth's field for the region is known.

From an archaeological point of view, archaeomagnetism still has but limited application because systematic records of the secular variation in the earth's magnetic field have been kept for only a few areas. Declination and dip have been recorded in London for 400 years, and a very accurate record of variations covers the period from A.D. 1600 to the present. France, Germany, Japan, and the southwestern United States have received some attention. Highly accurate AMS radiocarbon or tree-ring dates offer potential for longer magnetic timescales. In the Southwest, clay samples associated directly with dendrochronological or radiocarbon samples have been tested, with one set of readings from sixteen pre-Columbian villages extending back almost 2,000 years.

Obsidian Hydration Dating This method can be used over the entire span of human existence. Obsidian is a natural glass substance formed by volcanic activity (Leute, 1987). It has long been prized for its sharp edges and other excellent qualities for toolmaking. **Obsidian hydration dating** makes use of the fact that a freshly made surface of obsidian will absorb water from its surroundings, forming a measurable hydration layer that is invisible to the naked eye (no other known artifact material has this property). Because the freshly exposed surface has a strong affinity for water, it keeps absorbing until it is saturated with a layer of water molecules. These molecules then slowly diffuse into the body of the obsidian. This hydration zone contains about 3.5 percent water, increasing the density of the layer and allowing it to be measured accurately under polarized light. Each time a freshly fractured surface is prepared, as when a tool is being made, the hydration begins again from scratch. Thus, the depth of hydration achieved represents the time since the object was manufactured or used. Hydration is observed with microscopically thin sections of obsidian sliced from artifacts and ground down to about 0.003 inch (76 mm). Neutron activation analysis is now commonly used; it provides not only dates but also sourcing information that can be used to monitor changes in trade networks (see [Chapter 16](#)).

Obsidian hydration dating has been used with great success in Mesoamerica, notably in a ten-year dating campaign at the Maya city of Copán (Freter, 1993). The researchers were careful to collect information on such critical environmental variables as temperature,

rainfall, and soil acidity from weather stations, from wet and dry thermal cells buried at various depths in the sites to be dated, and from soil composition measurements, collected for as many years as possible. Ann Corinne Freter called this a “conjunctive approach” that brought all kinds of chronological data and a formal investigation of all the variables that could affect hydration into a single chronological project. Thus, the accuracy of obsidian hydration dates was checked at every turn.

The Copán Obsidian Dating Project began in 1984 and has yielded more than 2,300 dates from 252 sites, over 17 percent of the sites in the Copán Valley. The method was ideal for Copán, where radiocarbon and archaeomagnetic dates are rare and expensive, whereas obsidian hydration is relatively cheap. At the same time, the abundance of obsidian in both the central core and in outlying rural settlements allowed the economical dating of large numbers of sites. Thus, Freter and her research team were able to plot changing settlement patterns from A.D. 500 to 1150 with such chronological accuracy that they were able to show that the collapse of the Copán state was rapid between 800 and 850. (There is more on the Copán survey in [Chapter 15](#).) Freter points out that, given constant environmental conditions within a site, obsidian hydration has great potential for providing relative chronologies and identifying sites with disturbed occupation layers.

Summary

1. Absolute (chronometric) dates are expressed in years. In contrast, relative dates represent relationships in time that are used to correlate prehistoric sites or cultures with one another, which are based on the law of superposition.
2. Early archaeologists studied the evolution of artifact styles over time. This approach developed into the technique of seriation. Seriation assumes that artifacts come into fashion, have a period of maximum popularity, and then slowly go out of style. Tested against the evidence of New England tombstones and other modern artifacts, seriation has become an effective way of ordering sites in chronological sequence.

3. The historical records and calendars that were developed by such peoples as the ancient Egyptians and the Maya have been of immense value for dating these two literate civilizations. A great deal of valuable chronological information can also be obtained from objects of known age, such as clay pipes or coins. But, again, these objects are confined to the most recent periods of human history.
4. Cross-dating, widely applied in Europe and Mesoamerica, uses artifacts of a known age, such as coins and other items that were widely traded, to provide relative dates for sites in areas that have no historical chronology.
5. Dendrochronology (tree-ring dating) provides an accurate chronology for about 2,000 years of prehistory of the American Southwest and can be used on sites as early as 8000 B.C. in Europe. Dendrochronologists count the annual growth rings in trees such as the bristlecone pine and correlate them into long sequences of growth years that are joined to a master chronology. Wooden beams and other archaeological wood fragments are correlated with this master chronology to provide accurate dates for pueblos and other sites.
6. Radiocarbon dating is the most widely used method. It can be applied at sites from 40,000 to 400 years before the present. Based on the rate at which carbon-14 decays to nitrogen in organic objects, it can be used to date such materials as charcoal and bone and even skin and leather. Today, AMS dates provide a much higher degree of accuracy and use tiny fragments of organic materials. The accuracy of radiocarbon dating is subject to statistical errors. Dates up to 30,000 years ago are calibrated against tree-ring chronologies, ice cores, and coral growth sequences, due to variations in the carbon-14 content of the atmosphere.
7. Potassium-argon methods are used for dating the earliest human beings. These can be used to determine dates from the origins of the earth up to about 50,000 years ago. This radioactive counting method is based on measuring accumulations of argon-40 in volcanic rocks.
8. Electron spin resonance and uranium series dating are also

experimental chronometric methods that date sites between a million and 50,000 years old.

9. Thermoluminescence may prove to be a method for dating potsherds, in which the baked clay has trapped electrons; these are released for measurement by sudden and intense heating under controlled conditions. The visible light rays emitted during heating are known as thermoluminescence. Thermoluminescence can also be applied to burnt flint artifacts of much greater age.
10. Other dating methods include fission track and obsidian hydration, both of limited application.

Further Reading

- Aitken, M. J. 1990. *Science-Based Dating in Archaeology*. New York: Longman.
- Leute, U. J. 1987. *Archaeometry*. Weinheim, West Germany: VCH.

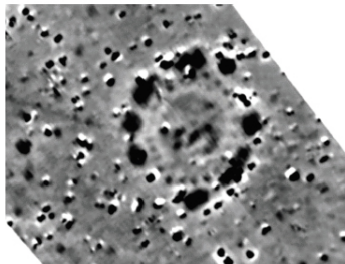
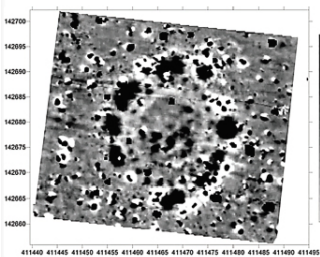
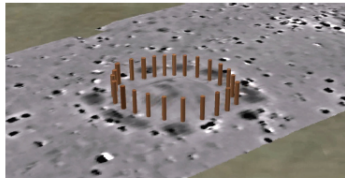
PART III

RECOVERING THE DATA

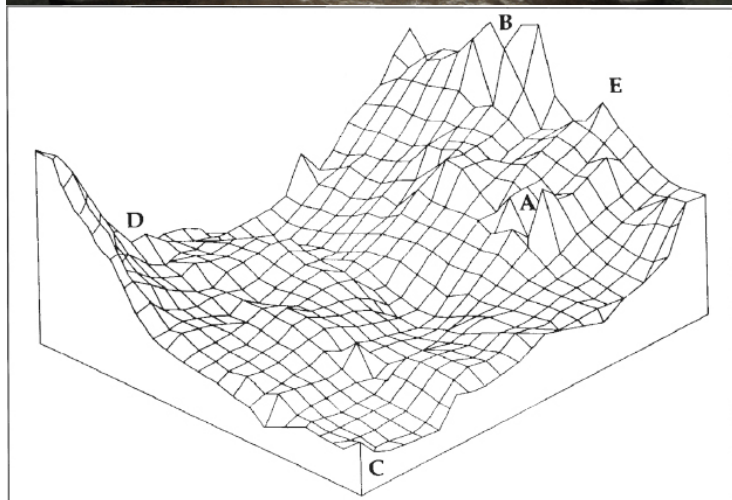
[Part III](#) deals with the ways in which archaeologists acquire data. As stressed earlier, the gathering of such data is done in a systematic way that depends on a sound research design. Archaeologists are then able to obtain the information best suited to address the specific research questions they are interested in. Our knowledge of the past is limited by the materials that are preserved in the ground and by our own methods for recovering data. [Chapters 8](#) and [9](#) describe some of the fundamental principles and processes of archaeological fieldwork, as well as some of the special problems encountered by archaeologists. Many examples are used, rather than drawing on a single case study, and it is hoped that instructors will use examples from their own experiences to illustrate the diversity of situations that archaeologists face.











8

They Sought It Here, They Sought It
There

Finding the Past

CHAPTER OUTLINE

Finding Archaeological Sites
Approaches to Archaeological Survey
Remote Sensing
Recording Archaeological Sites
Assessing Archaeological Sites
Subsurface Detection

The Pyramids of Giza and the Sphinx, Egypt, photographed from an Ikonos satellite.

Source: Courtesy of Universal History Archive/Getty Images.

In 1649, a gentleman antiquarian named John Aubrey galloped into the middle of the village of Avebury in southern England while fox hunting. He found himself surrounded by a deep ditch and mysterious, weathered stones erected in a circle inside the earthwork (see [Figure 8.1](#)). Aubrey was “wonderfully surprized at the sight of these vast stones, of which [he] had never heard before” and returned later to sketch and explore (Fagan, 1998: 117). Aubrey never excavated at Avebury, but he made the first survey of one of Britain’s most remarkable sacred monuments. He speculated that it had been built by ancient Britons, “who were, I suppose, two or three degrees less savage than the Americans.” Today, the Avebury stone circles are one of the most famous archaeological sites in Europe.

Some archaeological sites, such as the pyramids of Giza in Egypt (see above) or the stone circles at Stonehenge, 23 miles (37 km) south of Avebury (see [Figure 2.3](#) on page 29), are so conspicuous that they have never been “discovered” by archaeologists. Avebury was well known to local farmers in Aubrey’s day, but he was the first person to draw the site to the attention of a wider scientific community. Earthworks, burial

mounds, and entire cities are relatively easy to find, for they form an easily identifiable part of the modern landscape. But how do archaeologists locate inconspicuous Stone Age foraging camps, tiny farming villages, and sites that leave no traces on the surface whatsoever?

Figure 8.1 Aerial photograph of the stone circles at Avebury in southern Britain, built around 2000 B.C.

Source: Courtesy of Hideo Kurihara/Alamy Stock Photo.

Until recent years, archaeologists often paid relatively little attention to the techniques for locating archaeological sites and assessing them without actual excavation. Although excavation remains central to archaeological research, new emphasis on regional archaeological studies, innovative remote-sensing techniques, and, above all, the urgent need to save and record sites before they are destroyed by development have added a new dimension to archaeological research.

Data on the location and distribution of archaeological sites, combined with the assessment of archaeological material recovered from sites, can be used to address a diversity of research questions, ranging from change in subsistence strategies and ancient trade patterns to the origins of iron technology. In some instances, data are gathered to protect and manage archaeological resources. Cultural resource management (CRM) archaeologists spend much of their time evaluating the potential impact of development projects, such as road and building construction. Federal and state laws in the United States now mandate archaeological investigations before construction or other disturbance begins on publicly owned land and on private property if government funds are involved. Many cities and counties have similar regulations, designed to prevent the destruction of chance finds. The identification and evaluation of archaeological resources prior to development allow decisions to be made as to whether sites should be further investigated or protected.

In the pages that follow, we will review some of the archaeologist's techniques for locating, studying, and assessing archaeological sites with little or no excavation (White and King, 2007).

The interpretation of archaeological field data involves two

interrelated processes:

1. **Archaeological survey** is the systematic attempt to locate, identify, and record the distribution of archaeological sites on the ground and in relation to their natural environment.
2. **Site assessment** is the evaluation of each site's archaeological significance. Assessment considers site location and evaluates data from controlled surface collections and, in some cases, information from subsurface detection using electronic and limited subsurface testing.

Both these aspects of archaeological study are nonintrusive, in the sense that they do not, for the most part, destroy archaeological context. Archaeological excavation (see [Chapter 9](#)), in contrast, involves the investigation of the site by means of actual digging. In the process, artifacts, features, and, in some instances, entire structures are removed from their stratigraphic context and must be meticulously recorded by the archaeologist. In these days of wholesale destruction of archaeological sites through industrial activity, deep plowing, and illegal excavation, archaeologists do all they can to avoid disturbing subsurface levels. This destruction and the need for management of archaeological resources of all kinds (see [Chapter 18](#)) make the assessment of archaeological sites a critical concern.

Finding Archaeological Sites

Archaeological sites manifest themselves in many ways. Some may be quite evident, as in the case of city mounds, which are literally manmade mountains made up of occupation debris. Others may be identified by conspicuous ruins or the presence of **middens**, which are mounds of food remains and trash. But many others are far less easily located, perhaps displaying no more than a small scattering of stone tools or a patch of discolored soil. Still other sites leave no traces of their presence above the ground and may come to light only when the subsoil is disturbed. Let's examine some key indicators of archaeological sites:

- Conspicuous earthworks, stone ruins, or other surface features are among the most obvious indicators. Good examples are the *fortified pa*, or defensive earthworks, built by the Maori in New Zealand, or massive earthworks and stone circles such as Avebury, already mentioned. The **tells** (city mounds) of southwestern Asia, occupied by generation after generation of city dwellers, were easily recognized by early travelers, and the temples and monuments of ancient Egypt have attracted antiquarian and plunderer alike for many centuries (see [Figure 8.2](#)). Archaeological sites in the Americas, such as Teotihuacán, were described by some of the first conquistadors. Maya sites were vividly cataloged by John Lloyd Stephens and Frederick Catherwood in the mid-nineteenth century (Bahn, 1996).
- Surface finds of artifacts, bones, pottery, and other materials may be the principal surface indicator of some archaeological sites. A variety of factors, including vegetation, plowing, and water and wind erosion, as well as the nature of the artifacts themselves, can affect the visibility of surface materials. Such remains may consist of a thin scattering of artifacts or show up as dense concentrations of debris that stand out from the surrounding ground. In some cases, wind erosion may remove the soil surrounding artifacts and leave them exposed on the surface. Burrowing animals living in sites can also bring artifacts to the surface.

[Figure 8.2](#) The temple of the sun god Amun at Karnak, near Thebes, Egypt, a famous tourist destination since Roman times.

Source: Courtesy of Allstar Picture Library/Alamy Stock Photo.

- Vegetation is also a useful indicator, for plants may grow more lushly on areas where the subsoil has been disturbed or the nitrogen content of the soil is greater. Conversely, many California shell middens are covered with stunted vegetation, a result of the artifact-filled, alkaline soil, which contrasts sharply with the surrounding green grass at the end of the rainy season. Sometimes, specific types of trees or brush are associated with archaeological sites. One is the breadnut, or ramon, tree, which

was once cultivated by the Maya. These trees are still common near ancient settlements and have been used as guides in locating many archaeological sites.

- Soil discolorations can also be a sign of archaeological sites. In many cases, the dark midden soils of long-abandoned villages show up in plowed land as dark zones, often associated with potsherds and other artifacts.

Chance Discoveries

Whole chapters of the past have been exposed by accidental discoveries of sites, artifacts, or burials. Farming, industrial activity, highway construction, urban renewal, airport expansion, and other destructive actions of twentieth-century life have unearthed countless archaeological sites, many of which have to be investigated hurriedly before the bulldozers remove all traces. Development is a bitter enemy of the past. Yet sensational discoveries have resulted from our despoiling of the environment.

Mexico City is built on the site of Tenochtitlán, the capital city of the Aztecs. Tenochtitlán, destroyed by the Spanish under Hernán Cortés in 1521, was a wonderful city whose markets rivaled those of most major Spanish cities in size. Little remains of Tenochtitlán on the surface today, but the contractors digging tunnels for the city's Metro found more than 40 tons (36 tonnes) of pottery, 380 burials, and even a small temple dedicated to the Aztec god of the wind, Ehecatl-Quetzalcoatl. The temple is now preserved on its original site in the Pino Suárez station of the Metro system, part of an exhibit commemorating Mexico City's ancestry. Another accidental discovery of a ceremonial stone depicting the sun led to the uncovering and excavation of the Temple of the Sun and Rain Gods of the Aztecs, Huitzilopochtli and Tlaloc, which lay in the heart of the Aztec capital (Townsend, 2009). In Athens, Greece, excavations for the Monastriki station, part of the city's new Metro system, revealed traces of occupation from the eighth century B.C. right up to the nineteenth century A.D. , including graves, houses, and workshops lying along the banks of a river that was roofed over and turned into a sewer by the Romans.

Many other spectacular finds result from human activity. In June

1968, a detachment of China's People's Liberation Army on patrol among the barren hills near Man-Zh'ieng in central China stumbled on a subterranean burial chamber. They found themselves inside a vast rock-cut sepulcher where their flashlights caught the glint of gold, silver, and jade. Bronze and clay pots stood in orderly rows. Fortunately for science, the soldiers reported their find to the Academy of Sciences in Beijing, who sent experts on-site within hours. They rapidly identified the tomb as that of Liu Sheng, a prominent Han nobleman, elder brother of the emperor and governor of the principality of Zhoushan until his death in 113 B.C. A few days later, the nearby tomb of Liu Sheng's wife, Tou Wan, came to light. The Han emperors were the longest-lived dynasty of Chinese rulers, assuming power in 206 B.C. and reigning for 400 years. Han rulers developed the Great Silk Road across Central Asia and sent trading missions deep into Southeast Asia, making China a major power. The two tombs reflected the prestige and wealth of a man and woman at the pinnacle of Han society. Both wore jade suits made up of hundreds of thin plaques sewn together with gold wire (see [Figure 8.3](#)).

[Figure 8.3](#) The jade suit of Princess Tou Wan, late second century B.C. , China.

Source: Courtesy of VCG Wilson/Corbis via Getty Images.

[Figure 8.4](#) The Head-Smashed-In bison kill site, Alberta, Canada, used as a cliff for killing hundreds of bison over many millennia.

Source: Courtesy of All Canada Photos.

Nature itself sometimes uncovers sites for us, which may then be located by a sharp-eyed archaeologist looking for natural exposures of likely geological strata. Erosion, flooding, tidal waves, low lake levels, earthquakes, and wind action can all lead to the exposure of archaeological sites. Some of the most famous sites to be exposed in this manner are in Olduvai Gorge, in Tanzania, a great gash in the Serengeti Plains where earth movement and erosion have sliced through hundreds of feet of Pleistocene lake beds to expose numerous site locations of early human ancestors. It is the natural environmental setting of Olduvai, which has brought so many finds to light, that makes the gorge so unique.

In 1957, an amateur archaeologist reported what initially appeared to be five piles of bison bones and a few projectile points exposed in an arroyo near the town of Kit Carson in southeastern Colorado (Wheat, 1972). The dense concentration of bone, subsequently known as the Olsen-Chubbuck site, lay in a filled bison trail of the type that crisscrossed the plains in early frontier days (see [Figure 8.4](#)). The remains of nearly 200 bison were eventually excavated from the arroyo, many of which had been butchered. Clearly, the arroyo was a trap into which the beasts had been stampeded. Bison have a keen sense of smell but poor vision; a lumbering herd of these gregarious beasts can be readily stampeded into an abrupt declivity, and the leaders have no option but to plunge into the gully and be immobilized or disabled by the weight of those behind them. So vivid a reconstruction of the Paleo-Indians' hunt could be made that excavators could even guess at the direction of the wind on the day of the stampede. The dramatic evidence of this hunt of 8,500 years ago was buried in the arroyo by nature and exposed again in our time, to be discovered by the vigilant eye of an amateur archaeologist.

Documentary Records and Oral Traditions

For archaeologists working on more recent time periods, documentary records and oral traditions may provide important sources of information. Classical Greek and Roman texts, Egyptian hieroglyphs, or cuneiform inscriptions may refer to archaeological sites and, in some instances, actually preserve maps showing the location of ancient sites. A written account of the destruction of the classical Roman town of Pompeii during the eruption of Vesuvius in A.D. 79 was recorded in letters by Pliny the Younger to a fellow author, Tacitus, and inscriptions excavated at the site in the eighteenth century confirmed the town's location. Famous sites like the Parthenon are referred to in many classical texts and they have never been lost (see [Figure 1.5](#) on page 11). The Acropolis at Athens was remembered even when Athens itself had become an obscure medieval village.

Historical archaeologists working on the more recent past often have quite detailed records to help them locate archaeological sites. For example, in studying colonial St. Augustine, a Spanish Creole town in

Florida, archaeologist Kathleen Deagan was able to rely on maps to chart the town's growth, the location of the principal buildings, and even the names and ethnicity of some of the house owners (1983). Yet written records and plans cannot necessarily be taken at face value. The major African trading entrepot of Elmina, Ghana, which flourished following the arrival of the Portuguese in the late fifteenth century, is depicted in numerous illustrations and plans, but many of these are lacking in scale and perspective and others are entirely spurious (DeCorse, 2001). Despite the presence of written records, it was archaeological data that provided the details of the town's arrangement.

Oral traditions have been particularly important in African archaeology. While there are indigenous African writing systems, such as the ancient Ge'ez script of Ethiopia, oral traditions—memories passed on from generation to generation—are important in many cultures. Stories, songs, and epics recount rulers and important events, as well as the location of sites. A striking example is Begho in central Ghana, which reached its peak between the fifteenth and the eighteenth centuries A.D. This important African trading settlement was divided into four quarters, the names of which were recalled in the oral traditions of the modern village of Hani.

In other instances, sites ranging from early twentieth-century California mining towns to Native American villages have been located using oral histories: the personal memories, reminiscences, and accounts of individuals who lived at, worked in, or visited the sites. In addition to location, oral histories may provide important information about activities, events, and the identities of the inhabitants of a settlement.

Archaeological Survey

Although chance and nonarchaeological sources play an important part in discovery, the greater part of archaeological research involves researchers actively looking for sites. Most of the world's archaeological sites are far less conspicuous than the Parthenon, and, unlike Homeric Troy, they have no historical records to testify to their existence. Early antiquarians discovered sites primarily by locating burial mounds, stone structures, hill forts, and other conspicuous traces of past human activity on the landscape. Archaeological surveys were aimed at

identifying individual sites for excavation. Monumental architecture, spectacular sculptures, and ceramic sequences were consistent with early antiquarian objectives and later culture-historical concerns (see [Chapters 2 and 3](#)). Although such finds provided important information, the haphazard, unsystematic approach to locating sites yielded an incomplete view of the past.

Systematic **site survey** did not become a serious part of archaeology until twentieth-century archaeologists began to realize that people had lived their lives against the background of ever-changing cultural and natural landscapes, modified by ecological change and human activities. Individual sites cannot be evaluated without taking this broader background into consideration. As archaeologists have grown more intent on explaining cultural processes, they have increasingly focused on entire regions rather than individual sites. Although archaeologists still search for sites to excavate, most do so with broader research questions in mind.

Archaeological surveying is one of the most important components of archaeological investigation, for it is concerned with the archaeological record of ancient settlement patterns, with ancient peoples' imprints on the land. An archaeological survey seeks to identify ancient landscapes, which are far more than merely site dots or settlement patterns plotted on a map. A landscape is both material and symbolic, for every society has given meaning to its surroundings. For example, ritual sites such as the Avebury stone circles or the great pyramids never functioned in isolation. They were part of a much wider landscape and complex relationships among living people, the forces of the spiritual world, and the environment. Archaeologists have only the material remains of such relationships to study, so many of them refer to landscape "signatures," the material imprints left on the earth's surface by past human groups.

This approach makes archaeological surveying a much more important component of archaeological investigation than ever before, especially when studying hunter-gatherers or herders, who enjoyed a highly mobile lifeway and left few traces behind them. Like experts on ancient scripts, we are in the decipherment business, but our "script" is a mosaic of sites and many other conspicuous, and inconspicuous, remains of human activity.

Archaeological survey often means walking—a large-scale survey means lots of it, day after day, week after week—on carefully laid out transects that cross hill and dale. We always enjoy survey, for you develop a sense of the local landscape, meet all kinds of people, and get a unique impression of a place you might otherwise never encounter. And there is always the prospect of an important discovery. One of us (Brian) spent a month looking for Stone Age rock shelters in southwestern England and found no traces of human occupation whatsoever, returned from a week in southern Zambia with records of over 30 large mound villages, and walked in the Maya rain forest where you can see for only a few feet on either side. Meanwhile, the other (Nadia) spent one December on the blisteringly hot Yemeni coastal plain surveying everything from prehistoric shell middens to an abandoned medieval mosque (Durrani, 2005). Survey is fascinating because no two days are alike and the rewards can be immense.

In recent years, archaeologists have paid increasing attention to what they call **off-site** areas, places with a low density of artifacts or features such as plow marks or irrigation ditches. These locations may not represent major occupation areas but such areas are of vital importance because they may reveal important clues about activities such as farming, food processing, and technology that took place in areas spatially separated from the areas where people lived. For example, hunter-gatherers often killed and butchered wild game some distance from settlements. In West Africa, iron smelting furnaces were often located well away from villages. Entire field systems may be spotted only from faint traces visible in aerial photographs. At Céide Fields in northwestern Ireland, for example, more than 5,000 acres (2,023 ha) of field systems dating to about 5000 B.C. are preserved, and they are as revealing about the society that created them as the associated settlements because they provide vital environmental and social information (see [Figure 15.1](#) on page 289).

An archaeological survey can vary from spending an afternoon searching a city lot for traces of historical structures to doing a large-scale survey over several years of an entire river basin or drainage area. In all cases, the theoretical ideal is easily stated: to record all traces of ancient settlement in the area. But this ideal is impossible to achieve. Many sites leave no traces above ground. And no survey, however

thorough and however sophisticated its remote sensing devices, will ever achieve the impossible dream of total coverage. The key to effective archaeological survey lies in carefully designing the research before one sets out and in using techniques to estimate the probable density of archaeological sites in the region.

Archaeological surveys are most effective in terrain where the vegetation is burned off or sparse enough for archaeologists to be able to see the ground. In lush vegetation areas such as those of the American South, only the most conspicuous earthworks will show up. And, of course, thousands of sites are buried under housing developments, parking lots, and artificial lakes, which have radically altered the landscape in many places.

When surveying by foot, the archaeologist can locate the traces of artifacts, the gray organic soil eroding from a long-abandoned settlement, and the subtle colors of rich vegetation that reveal long-buried houses. Plowed fields may display revealing traces of ash, artifacts, or hut foundations. Scatters of broken bones, stone implements, potsherds, or other traces of prehistoric occupation are easily located in such furrowed soil. Observation is the key to finding archaeological sites and to studying the subtle relationships between prehistoric settlements and the landscape on which they flourished.

Archaeologists have many inconspicuous signs to guide them. Gray soil from a rodent burrow, a handful of humanly fractured stones in the walls of a desert arroyo, a blurred mark in a plowed field, a potsherd—these are the signs they seek. After a few days, you learn to spot the telltale gray earth sent up by burrowing animals from village sites from some distance off. And often, knowledgeable local inhabitants, especially landowners who have an intimate knowledge of their own acreage, provide information on possible sites.

There is far more to archaeological survey than merely walking the countryside, however. And a great deal depends on the intensity of the field survey. The least intensive survey is the most common: the investigator examining only conspicuous and accessible sites, those of great size and considerable fame. Heinrich Schliemann followed just this procedure when he located the site of ancient Troy at Hissarlik in Turkey in the 1870s. John Lloyd Stephens and Frederick Catherwood did the same when they visited Uxmal, Palenque, and other Maya sites

in Mesoamerica in the early 1840s. Such superficial surveys barely scratch the archaeological surface.

A more intensive survey involves collecting as much information about as many sites as possible from local informants and landowners. Again, the sites located by this means are the larger and more conspicuous ones, and the survey is necessarily incomplete. But this approach is widely used throughout the world, especially in areas where archaeologists have never worked before.

Many more discoveries are made if archaeologists undertake a highly systematic survey of a relatively limited area. This type of survey involves not only comprehensive inquiries among local landowners, but actual systematic on-site checking of those reports. The footwork resulting from the checking of local reports may lead to more discoveries. But, again, the picture may be very incomplete, for the survey deals with known sites and does not cover the area systematically from one end to the other or establish the proportions of each type of site known to exist in the region.

The most intensive surveys have a party of archaeologists covering a whole area by walking all over it, often in straight lines, with a set distance between them. Such surveys are usually based on carefully formulated research designs. The investigators are careful to check that their site distributions reflect actual settlement patterns rather than where archaeologists walked.

Partly because regional studies have become more fashionable, and partly because of the growing demands of cultural resource management, archaeologists have become deeply interested in economical methods for collecting survey data. Many of them now use a variety of remote sensing methods and techniques that allow them to determine, or partially assess, the presence of archaeological features without visiting the site.

Approaches to Archaeological Survey

A survey can vary from searching a city lot for historical structures to a tiny river valley with a few rock shelters in its walls to a large-scale survey of an entire river basin or water catchment area—a project that would take several years to complete. Often, the theoretical ideal is the

same: to recover all or nearly all traces of ancient settlement in the survey area. This is often, however, impractical.

Many people make a fundamental distinction between two types of survey (Hester et al., 2008):

1. **Reconnaissance survey** is a preliminary examination of a survey area to identify major sites, to assess potential, and to establish tentative site distributions. Reconnaissance survey also involves background research, such as examining archives if historical properties are involved, talking to landowners, and acquiring general environmental information.
2. **Intensive survey** is a systematic, detailed field survey that covers an entire area. It may include subsurface testing.

Most surveys are in the reconnaissance category, especially if large areas are involved. Archaeological features are located in a variety of ways. The survey area can be traversed by automobile, horseback, mule, camel, bicycle, or foot. Footwork is important, for it enables the archaeologist to acquire an eye for topography and the relationships of human settlement to the landscape. However, as discussed later, various types of subsurface testing, aerial photographs, and remote-sensing methods are increasingly used (see the Doing Archaeology box).

Doing Archaeology Basic Types of Ground Survey

Archaeological surveys range from intensive surveys that seek to identify all archaeological sites within a region to reconnaissance surveys that provide only preliminary information for an area. In practice, actual fieldwork spans a continuum of levels in between. There are four basic types of intensive ground survey:

1. *Conspicuous and accessible sites* are located by superficial survey, such as that used by Catherwood and Stephens for Maya sites in the Yucatán in the 1840s (see [Figure 8.5](#)). The investigator visits only very prominent and easily reachable sites.
2. *Relatively conspicuous sites at accessible locations* are studied in the next level of survey, with the assistance of local informants such as landowners. This approach was used frequently in the

1930s for the classic river basin surveys in the lower Mississippi Valley, when archaeologists worked on Depression-era survey projects. Such surveys, although effective, give a rather narrow view of the archaeological sites in an area.

3. *Limited-area survey* involves door-to-door inquiries, supported by actual substantiation of claims that a site exists by checking the report on the ground. This type of survey, with its built-in system of verification, may yield more comprehensive information on sites. But it still does not give the most critical information of all, data on the ratios of one site type to another within an area, nor does it assess the percentage of accessible sites that have been found.
4. *Intensive foot survey* occurs when a party of archaeologists covers an entire area by walking over it, perhaps with a set interval between members of the party. This is about the most rigorous method of survey, but is only realistic when applied to relatively small areas such as a small housing tract or an area to be covered by a few buildings, also outlying structures such as barns or privies; there are numerous instances when the approach is appropriate.

The chances of any archaeological ground survey recording every site, in even a small area, are remote. Obviously, though, total survey of an area is desirable, and sometimes nearly total coverage can be achieved by combining remote sensing and ground survey. The Stonehenge Hidden Landscapes Project, launched in 2010, is a good example of this. It mapped over 5 square miles (12.9 sq. km) of the landscape around Stonehenge using ground-based remote sensing tools. Mounted behind quad bikes and mini-trackers the team used a state-of-the-art magnetometer and geo-radar system, capable of “seeing below the ground,” making and processing millions of measurements and producing pin-sharp images in real time. Within the first month of the project’s launch, the team located a previously-unknown henge-like monument lying not more than 1,000 yards (900 m) from the site’s iconic stone circle. Archaeologists had long been aware of the sacred nature of much of the landscape around Stonehenge—but what lay below the ground in some 90 percent of the area around the main henge

remained unknown prior to this project.

Figure 8.5 Copán in Honduras, a conspicuous archaeological site found by the Spanish in 1576 and made known by Stephens and Catherwood in the nineteenth century. This photograph shows the reconstructed ball court.

Source: Courtesy of Andrea Di Martino/Alamy Stock Photo.

Figure 8.6 Tools of the trade used by the Stonehenge Hidden Landscapes Project to produce 3D images of what lies beneath the surface.

Source: Courtesy of Professor Vincent Gaffney.

As noted, it would be ideal if archaeologists could map out and identify all archaeological resources within a region. Such holistic surveys are sometimes attempted. For example, William Sanders and his colleagues (1979) carried out a long-term archaeological survey of the Basin of Mexico in which they tried to locate every site in the area over many seasons of fieldwork. At the end of the project, Sanders argued that this approach was far more effective than any sampling of the area, for it gave a much clearer picture of site variability on the ground (Sanders et al., 1979). Undoubtedly he is right—if one has the time and the money. Yet in these days of limited budgets and short-term archaeological contracts dictated by impending site destruction, the examination of an entire region or an entire site by foot alone is often impossible and can be nearly always unrealistic in most settings.

For this reason, archaeologists have increasingly turned to sampling and a variety of new surveying techniques to locate and identify sites. The comprehensiveness of any survey is affected by other factors, too. Many are carried out in intensively populated areas or on private farmland. Thousands of sites lie inaccessible, buried under suburban housing and parking lots. Site survey can be further complicated by dense vegetation, crops, and floodwaters. In many parts of California, Mexico, and Africa, the obvious months for surveys are at the end of the dry season, when the vegetation is dry or even burned off. But in lush, lowland floodplains, such as those of the American South, large tracts of the survey area may be totally inaccessible all year, except to shovel testing and controlled surface collecting of known sites. Only the most conspicuous sites, such as mounds, show up under these

conditions.

In the Mesoamerican and Amazonian rain forests, where the vegetation is so thick that even new roads are in constant danger of being overgrown, it is no coincidence that many archaeological sites are found near well-trodden roads and tracks. The early archaeologists working in these regions located sites by following narrow paths through the forest cut by *chicleros*, local people who collected resin from forest trees and guided researchers to sites. Even today, archaeologists can pass right through the middle of a large site in the forest or within a few feet of a huge pyramid and see nothing.

No surface survey, however thorough and sophisticated, will achieve complete coverage. In the past, archaeological survey was often a haphazard, hit-or-miss process. Researchers would visit known sites or examine areas adjacent to existing paths cleared by farmers or fortuitously exposed by construction. These opportunities revealed archaeological sites but left many potential rich areas totally unexplored.

Many archaeological surveys, especially CRM projects, involve research in urban areas, where only limited areas are exposed for new construction. It is a fallacy to assume that no archaeological surveys can be made under cities, many of which occupy locations that were also used by prehistoric people. London and York in England have long, complex histories, much of which comes from archaeological research. Sometimes preservation conditions are surprisingly good, especially when earlier building foundations are shallow or when builders used fill to level the ground. Deep basements are the curse of urban archaeology, for they destroy everything in their path. The most successful urban surveys involve the careful use of archives and maps and a knowledge of earlier architectural styles and the social history of neighborhoods. Long-term urban archaeology—like that practiced with great success at Alexandria, Virginia, New York, and elsewhere—uses oral histories, documents, social anthropology, and even folklore (Murray, Karstens, and Mayne, 2004).

In contrast to the work of early antiquaries, modern archaeological surveys are typically systematic; that is, they approach sites using some consistent, predetermined method to ensure that all parts of the proscribed survey area are examined. Rather than attempting to

identify all of the sites within a particular area, modern archaeologists also make use of sampling, for archaeologists are only too aware that many site distributions reflect the distribution of archaeologists rather than an unbiased sampling of the archaeological record.

Predictive Survey

A **predictive survey** seeks to develop a database of sites for a large area without carrying out a complete survey. By using a small sample of sites from such an investigation, one can then extrapolate the results to an entire area, subsequently following up with intensive searches in the areas that are predicted to have the densest site concentrations. Predictive surveys are invaluable and cost-effective when one is surveying a large area prior to large-scale construction, strip mining, or other forms of land use.

Such surveys came into use during the early days of CRM in the 1970s and 1980s, when the federal government sponsored a number of them as part of land-management planning. But they were expensive to carry out in the days before geographic information system (GIS) software allowed the use of predictive modeling as part of the survey process. Such models can interface with statewide survey and planning programs, which are now commonplace for archaeological sites (Mehrer and Wescott, 2006).

Doing Archaeology Probability Sampling Schemes

Three basic probability sampling schemes are common in archaeological survey and excavation:

1. **Systematic sampling** chooses one unit at random and then selects others at equal intervals from the first one. This method is useful for studying artifact patterning on a surface site. However, because the samples occur at regular intervals, the method may produce a biased sample if archaeological material also falls at regular intervals.
2. **Simple random sampling** identifies a percentage of the survey area or site to be sampled. Numbers are assigned to a grid drawn over the survey area and the units to be sampled are determined

by means of a table of random numbers. The space between the sample units is therefore irregular. The data recovered from the sample are used to evaluate the archaeological resources of the entire survey area. This approach treats all samples as absolutely equal, which is a useful approach when surveying an unknown area or site.

3. **Stratified sampling** is used when sample units within an area are not uniform. They are divided into separate groups, or strata, that reflect observed variation within the area, such as different ecological zones, activity areas, artifact classes, and so on. This approach ensures that an adequate sample is obtained from each type of feature or environmental zone represented. Alternatively, such units permit intensive sampling of some areas and less detailed work on others.

Simple random sampling is the most common sampling strategy used in survey and excavation. Under ideal circumstances, however, the other two probability sampling methods make for more precise comparisons between and within sites. But field survey means dealing with such realities as patches of open and thickly vegetated terrain, uncooperative landowners, and urban sprawl. There is rarely a perfect world in the field, so the researcher has to watch carefully for bias in the data and select a sampling strategy that provides a truly representative sample of the total data universe.

Predictive surveys require first-rate research designs, which set forth the strategies to be used to sample the research area. These strategies will provide the database for making a set of predictions that can be rigorously tested. Much depends on detailed background research, on information on such topics as land use and human–environment relationships, which is then combined with data collected in the field. In the final analysis, too, much depends on the sampling strategies used for the predictive survey.

Sampling in Archaeology

Sampling is an enormous subject that cannot be discussed in detail here. But systematic and carefully controlled sampling of archaeological data is essential if we are to rely heavily, as we do, on statistical

approaches in the reconstruction of past lifeways and cultural processes. If we are interested in past adaptations to environmental conditions, then we must systematically sample many types of sites in each environmental zone, not merely those that look important or seem likely to yield spectacular finds. (For more details, see Mueller, 1974; Orton, 2000.)

Statistical sampling methods occupy an important place in archaeological research, and some training in statistics is now integral to every professional's training. The key to effective archaeological surveying lies in proper research designs and in rigorous sampling techniques to provide a reliable basis for extending the findings of the survey from a sample zone to a wider region. Archaeologists generally use **probability sampling**, a means of mathematically relating small samples of data to much larger populations. Classic examples of this method are public opinion polls, which may use tiny samples, say, 1,500 people, to draw more general conclusions on major political issues.

Sampling enables researchers to obtain a statistically reliable slice of archaeological data from which to generalize, the assumption being that the sample observations are a mathematical representation of the whole. Portions of a region, area, environmental zone, or site, or even the artifacts recovered are selected to serve as a representative sample of the larger area. Probability sampling improves the chance that the conclusions reached on the basis of the sample will be relatively reliable. The outcome depends, of course, on very carefully drawn research designs and precisely defined sample units.

Predictive surveys produce maps, which typically record the distribution and density of archaeological sites generally or record the distribution of different types of sites. These distributions are plotted against different environmental features within the sample units. This enables one to project similar site distributions in equivalent environmental zones in those areas that were not sampled. For example, the 85 known archaeological sites in the Racoon River Greenbelt in Dallas County, Iowa, were threatened by flooding, so much so that a GIS database was developed to model the 85 known prehistoric sites in a 208-square-mile (539 sq. km) segment of the protected area. The data included information on vegetation, soils, elevation, and archaeological sites. Four variables provided the basis for

predictive modeling: proximity to stream confluences, proximity to stream valleys, proximity to soils, and proximity to historic vegetation. By using multiple linear regression techniques, the researchers were able to identify areas with a high potential for additional sites, predictions that will be tested in future field research (Anderson, 1995).

The advantage of predictive surveys is that they are cumulative, in the sense that they are an ongoing process, becoming more and more fine-tuned as new samples of the area are surveyed in future years. In due course, at least theoretically, one will arrive at a 100 percent sample. This is a reasonable long-term goal for long-term comprehensive surveys of archaeological sites, such as are administered by state and federal authorities under the National Historic Preservation Act (see [Chapter 18](#)). In reality, a great deal of preservation planning and site management will take place before the survey is even half complete, which is why predictive modeling is so useful.

Remote Sensing

Increasingly, archaeologists are relying on elaborate instrumentation to help them discover the past. Some fieldworkers are beginning to talk about **nonintrusive (nondestructive) archaeology**, which is the analysis of archaeological phenomena without excavation or the collecting of artifacts, both activities that destroy the archaeological record. The major methods in this approach are generally called **remote sensing** (Kvamme, 2005; Scollar et al., 1990).

Remote sensing techniques include aerial photography, various magnetic prospecting methods, and side-scan radar. These methods have revolutionized some aspects of archaeological research but they probably will never completely supersede the traditional task of the archaeologist: investigating archaeological sites on the ground. The primary purposes of many remote-sensing surveys are to map concentrations of sites and, on larger projects, to identify where maximal efforts in ground surveying and excavation should be concentrated. Such surveys are also invaluable for placing sites within environmental zones and long vanished cultural landscapes, much of which are invisible to the naked or uninformed eye. Remote sensing—

particularly aerial photography—has also been extremely useful in mapping large and complex sites that are more clearly viewed from the air.

Google Earth

Today, many archaeologists begin with cheap and readily accessible remote sensing—with Google Earth. Google Earth (GE for short) is software that allows anyone with a computer to obtain a comprehensive aerial view of the world. Basically a highly detailed, high-resolution map of the world, you can use a GIS client (easily installed on your machine) to add labels known as place markers to the maps to mark the locations of sites and other archeological data—to say nothing of restaurants and other attractions. Once your place markers are located, you simply post them to a bulletin board at GE. Your markers can be simply location points, or you can add all kinds of data to suit your needs. There is even a somewhat disorganized “Find the Archaeology” game on the Google Earth Community Bulletin Board. Someone posts an image of a site: you have to guess where or what it is.

One of the longest-running archaeological remote sensing projects is in the Arroux Valley area of Burgundy in France, where a team of scientists from many disciplines are studying the complex and changing interactions between different societies and the physical environment. Researcher Scott Madry has identified over 100 French sites using GE, a quarter of which were previously unrecorded. Other researchers have recorded earthworks in Ohio, used GE to traverse the Inca Trail in the Andes, and explored Southwestern pueblos. An excellent starting point to browse is www.jqjacobs.net/archaeo/sites/. But be warned that Jacobs predicts that you may soon suffer from GE addiction!

In another example, Australian archaeologist David Thomas was unable to go on a field survey in the Registan Desert of Afghanistan due to security concerns. Instead, Thomas and his research team used GE at a height of 984 feet (300 m) to locate what he thinks are 450 potentially significant sites in a hitherto virtually unexplored landscape. The locations include camp sites, villages centered on mosques, animal corrals, and water features like dams.

Archaeologists in many parts of the world are now using GE, especially with CRM projects involving extensive surveys and for more remote locations where access is difficult. Both GE and global positioning systems (GPS), combined with excavations, have revealed raised Maya field systems in wetlands over in one area over 62 miles (100 km) across (Beach et al., 2009). Maya farmers exploited swampy terrain on a large scale. How large, we are only now beginning to discover.

GE cannot take the place of survey on the ground, but it can provide valuable information on the potential benefits of a foot reconnaissance—and also allow you to tour ancient Rome in three dimension.

Aerial Photography

Aerial photography gives an unrivaled overhead view of the past. It came into use after World War I, when British archaeologist O. G. S. Crawford (1886–1957) observed sites while photographing German trenches from the air on the Western Front. Meanwhile, German aviators photographed ruins in the Sinai Desert. These casual observations led to serious research between the world wars, in the hands of Crawford and also of Charles Lindbergh of trans-Atlantic fame, who worked closely with Alfred Kidder in the Southwest, where he photographed Chaco Canyon, and in Mesoamerica, where he flew over Chichén Itzá and Tikal. Since then, numerous sites that have left almost no surface traces on the ground have come to light through the air photograph (Riley, 1987). Whole field systems and roadways have been incorporated into panoramas of prehistoric and Roman landscapes in Italy and North Africa. Well-known sites such as Stonehenge and many Mesoamerican and South American ceremonial centers have been mapped using aerial photographs.

Some of the most dramatic discoveries came from Chaco Canyon, New Mexico, where Gwinn Vivian mapped linear features that he thought were irrigation canals. When he dug into them, he found that they were deliberately leveled and carefully designed roadways. He mentioned his findings to Thomas Lyons, a geologist, and together they examined aerial photographs of the canyon, including some taken by Lindbergh that dated to before the time when grazing was permitted

there. They soon found clear traces of a road system, commissioned more flights, and identified more than 186 miles (300 km) of road segments. When the National Aeronautics and Space Administration (NASA) flew over Chaco with a thermal infrared multispectral scanning (TIMS) device, they located a further 186 miles (300 km) of roads. TIMS measures the infrared thermal radiation given off by the ground and is sensitive to even small differences. A computer converts the data from the camera into “false-color” images that map the terrain in terms of infrared radiation. The Chaco roads showed up as clear, tan lines against the surrounding red sand, and yet they are only up to 4 inches (10 cm) deep—their existence was virtually unknown until remote sensing came along. A generation of archaeologists has puzzled over the Chaco road system, so far without success (Vivian, 1997). Often, the roads are just short segments that end in the middle of nowhere. Most segments are straight, others turn abruptly or are lined by low berms. We don’t know whether they were incomplete, or merely symbolic depictions of sacred directions. They converge on Chaco, where rock-cut stairways lead down the precipitous cliffs.

The interpretation of aerial photographs can be challenging. Archaeological features may be difficult to discern or may be revealed in unexpected ways. Most aerial photographs—at least those most readily available to archaeologists—are taken with black-and-white film, which, fortunately, gives definition superior to that of color film and is cheaper to buy and reproduce than color film. The wide range of filters that can be used with black-and-white also gives the photographer great versatility. Digital photography is, of course, now widely used. Different kinds of photography yield different kinds of details that, separately or in conjunction, may be used to identify archaeological sites. For instance, sites can be photographed obliquely or vertically, at different seasons or times of day, from varying altitudes, and with diverse types of lenses. Under certain conditions, subtle variation in topography, vegetation, or soil color may reveal archaeological sites or features, but cloud cover and haze can present serious problems.

Shadow Marks These are caused by slight variations in topography. Many earthworks, ditches, roads, and structures have been leveled by

plow or erosion, but their reduced topography still shows up clearly from the air. The rising or setting sun can set off long shadows, emphasizing the relief of almost-vanished banks or ditches so that the features of the site stand out in the oblique light, thus the term *shadow marks*.

Crop Marks Variation in crop growth sometimes provides an indication of buried archaeological features (see [Figure 8.7](#)). Such **crop marks** may be detected on the surface, but under favorable circumstances they may be seen especially clearly from the air. Crop marks result from the fact that the growth and color of plants are mainly determined by the amount of moisture they can derive from the soil and the subsoil. Topsoil depth can be increased when features such as pits and ditches have been filled in or when additional earth has been heaped up to form artificial banks or mounds. Crops growing over such abandoned structures are tall and well nourished. The converse is true where topsoil has been removed and the infertile subsoil is near the surface, or where impenetrable features, such as paved streets, are buried just below ground level. Crops in these areas are stunted. Thus, dark healthy plants may indicate a ditch or a pit; a lighter line of vegetation will define a buried wall or building foundation.

Soil Marks These result from the exposure of distinctive soil types on the surface that are indicative of archaeological features. Plowing or ground clearing may reveal dark patches of organic soil associated with midden deposits. On the other hand, traces of brick walls or earthen banks, built from subsoil, may show up lighter in color than that of the darker, deeper soil around them. While such traces may be visible on the ground, aerial photographs may reveal patterns virtually invisible on the surface.

Infrared, False-Color Photographs Infrared film, which has three layers sensitized to green, red, and infrared, detects reflected solar radiation at the longer wavelength radiation of the electromagnetic spectrum, some of which is invisible to the human eye. The different reflections from cultural and natural features are translated by the film into distinctive false colors. Bedrock comes up blue on infrared film, but vigorous grass growth on alluvial plains shows up bright red.

Experiments at the Snaketown site in the American Southwest, a great Hohokam Indian pueblo, trade center, and ceremonial center, did not show up new cultural features, but tonal contrasts within a color indicated various cultural components. Vigorous plant growth showing up red on infrared photographs has been used to track shallow subsurface water sources where springs were used by prehistoric peoples.

Nonphotographic Methods

Archaeological sites can be detected from the air, even from space, by nonphotographic techniques as well but aerial photography is the last of the “do-it-yourself” types of remote sensing, a technique whose cost is within the reach of even a modest archaeological expedition. Aerial sensor imagery, using aircraft, satellites, and even manned spacecraft, involves instrumentation that is astronomically expensive by archaeological standards. Thus, these exciting techniques are only occasionally used, and then only when the collaboration of NASA and other interested experts can be enlisted.

Figure 8.7 A crop mark of a Roman barracks exposed during an exceptionally warm English summer. Under favorable circumstances, such marks can be seen clearly from the air.

Source: Courtesy of fotolincs/Alamy Stock Photo.

Aircraft-Borne Sensor Imagery Aircraft-borne instrumentation of several types can be used to record images of the electromagnetic radiation that is reflected or emitted from the earth’s surface. A multispectral scanner, for example, measures the radiance of the earth’s surface along a scan line perpendicular to the aircraft’s line of flight. A two-dimensional image is processed digitally. Multispectral scanners are ideal for mapping vegetation and for monitoring bodies of water when more complete data are needed than can be obtained from aerial photographs. Thermal infrared line scanners were originally used for military night survey but now have many applications in the environmental sciences. The line scanners have thermal devices that record an image on photographic film. The temperature data obtained from such scans are combined with aerial photographs to reveal tiny

thermal patterns that may indicate different kinds of vegetation, the distribution of range animals, or variations in soil moisture and groundwater, both ancient and modern. But how do you get something like a thermal camera into the air? But how do you get something like a thermal camera into the air? Researchers are increasingly turning to the drones, or unmanned aerial vehicles, to find out more. (See the Doing Archaeology box.)

Doing Archaeology Drones to the Rescue: Saturday Creek, Belize

In this chapter we've discovered the main sorts of remote sensing equipment currently available. To get equipment such as thermal cameras into the air, archaeologists have used everything from small planes and helicopters to hot air balloons and kites. But over the past decade, archaeologists have begun to experiment with drones, otherwise known as unmanned aerial vehicles (UAVs).

Drones can fly for about 15 minutes on their own, at between 60 and 650 feet (20 and 200 meters) flying altitude. They can cover up to 740 acres (300 hectares) a day, far wider distances than a balloon or a kite, plus they cost just a few hundred dollars (and are getting cheaper) (Wade, 2014). However, their use is still relatively restricted compared with conventional air photography or aerial photogrammetry since they are best suited to open terrain—such as barren deserts or scrublands. Furthermore, few drones have any significant capacity to respond independently to variable wind conditions or to the presence of obstacles outside the direct sight-line of the pilot (Campana, 2017). Nonetheless, their use within archaeology is promising, and drones have already been successfully used throughout the world, as was the case at the Maya site of Saturday Creek, Belize (Harrison-Buck et al., 2016).

Saturday Creek is an at-risk site, and the team was keen to collect as much information about Saturday Creek and its hinterland before it was lost forever. Lying in agricultural land, the local farmers had already removed most of the stones from the site—remnants of once-intact ancient Maya architecture—to avoid damage to their plows. Repeated plowing had shaved off yet more from the area's ancient

mounds, making them hard to discern them from the ground. However, the area was relatively free of jungle vegetation, due to recent clearances, which meant the drones could range freely to efficiently collect high-resolution imagery.

Team members Willis and Walker flew four lightweight UAVs equipped with a digital camera, a GPS, and a radio receiver, controlled by a ground-based computer. In approximately eight hours, they had mapped roughly 620 hectares (1,530 acres), creating about 2,500 high-resolution photographic images. The rate of data collection was extraordinary compared to more traditional methods; indeed, the team recalls how it had previously taken two days to survey another local site, Hats Kaab with a Total Station, yet in under two days, the drones had covered an area 50 times the site of Hats Kaab.

After analyzing the 3D data, the archaeologists were able identify an unprecedented number of archaeological features in the open fields. While most seemed to be small earthen mounds, likely the remains of ancient Maya platform structures, there was also a triangular arrangement of structures—heavily bulldozed in recent years—which might have served to commemorate astronomical events, among other functions. In mapping the wider archaeological landscape, the team revealed how it had once consisted of an expansive regional settlement with Saturday Creek right at the center, surrounded by a densely settled supporting population.

To the archaeologists, the results of this study demonstrate how in high-risk or rescue situations, drones can offer a fast and effective solution, providing detailed maps of a site in a fraction of the time it takes to map with a total station. Ultimately, the Saturday Creek drone data produced a digital terrain model that contained over 100 million individual elevation points, which is comparable to the resolution collected by LiDAR systems, but—notes the team—at a fraction of the cost and time.

A project such as Saturday Creek shows how photogrammetric mapping with UAVs can offer an inexpensive and efficient way of salvaging important site information—in this case, before it is further damaged or erased altogether (Harrison-Buck et al., 2016).

Sideways-Looking Airborne Radar (SLAR) This technique senses the

terrain to either side of an aircraft's track by sending out long pulses of electromagnetic radiation. The radar then records the strength and time of the pulses' return to detect objects and their range from the aircraft. Because SLAR is not dependent on sunlight, it has great potential for archaeology. The flying aircraft enables the observer to track the pulse lines in the form of images, no matter what obscures the ground. The SLAR images are normally interpreted visually, using radar mosaics or stereo pairs of images, as well as digital image processors. SLAR was originally used for oil exploration, geology, and geomorphology, applications that justify its high cost.

SLAR is useful for mapping surface soil moisture distributions, something that has great potential for the study of ancient roads, such as the Silk Road between China and the West, and of ancient Angkor (Moore and Freeman, 1998) (see [Figure 8.10](#)). It can also show where changes in topography have taken place or where the subsoils of large sites have been disturbed. It can also be applied to underwater sites to locate wrecks on the seafloor. So far, applications of this exciting technology to the past have been few and far between, but experiments in the Mesoamerican lowlands have hinted that SLAR may be able to identify buildings beneath dense rain-forest canopy. Surface investigations at Pulltrouser Swamp in northern Belize have shown that Maya farmers exploited the edges of seasonally flooded swamps between 200 B.C. and A.D. 850. A rising population of farmers brought under cultivation more than 740 acres (300 ha) of raised field plots, linked with interconnecting canals. These fields were hoed, mulched, and planted with maize, amaranth, and perhaps cotton (Fedick, 1996; Turner and Harrison, 1983). The space shuttle *Columbia* used an imaging radar system to bounce radar signals off the surfaces of the world's major deserts in 1981. This experiment was designed to study the history of the earth's aridity, not archaeology, but it identified bedrock valleys in the limestone up to 20 feet (6 m) under overlying sand sheets in the eastern Sahara Desert. Such identifications were possible because of the arid deposits. Wetter soils do not permit such deep access, for the water table blocks the radar eye completely.

A team of geologists, including archaeologist C. Vance Haynes of the University of Arizona, journeyed into the desert to investigate the long-hidden watercourses. About the only people to have worked in this

terrain were British soldiers in World War II and Egyptian oil companies. The oil companies arranged for a skip loader to be transported into the desert. To Haynes's astonishment, the skip-loader trenches yielded some 200,000-year-old stone axes, dramatic and unexpected proof that early Stone Age hunter-gatherers had lived in the heart of the Sahara when the landscape was more hospitable than it is today. The Haynes find is of cardinal importance, for African archaeologists now believe that the Sahara was a vital catalyst in early human history that effectively sealed off both Archaic and modern Africans from the rest of the Ice Age world for many millennia.

The most accurate space images of all are, of course, in the closely guarded hands of the military. Despite the veil of secrecy, some astonishingly clear black-and-white satellite photographs have proved a bounty to geologists, who are expert in analyzing subtle tone, texture, and light reflections given off by rock formations on the earth. Herein lies a remarkable bonus for archaeology, for potential hominin fossil beds in Ethiopia and other parts of East Africa can be detected from shuttle images. Paleoanthropologists traditionally spend months on end combing hundreds of square miles of potentially fossil-bearing landscapes to locate promising deposits. John Fleagle of the State University of New York at Stony Brook, however, used shuttle photographs to investigate fossil beds in the Fejeji region of the Ethiopian Rift Valley. He returned months later with some 3.7-million-year-old hominin teeth from one of the earliest australopithecines yet discovered. Ethiopian archaeologists are now using images from space to develop an inventory of potential fossil deposits in their country.

Satellite Sensor Imagery This method is well known for its military applications, but earth resources technology satellites, both manned and unmanned, have proved extremely valuable for environmental monitoring. The most famous of these satellites are the LANDSAT series, which scan the earth with sensors that record the intensity of reflected light and infrared radiation from the earth's surface. The data from scanning operations are converted electronically into photographic images and from these into mosaic maps. Normally, however, these maps are taken at a scale of about 1:1,000,000, far too imprecise for anything but the most general archaeological surveys. The

first LANDSAT images could detect images about 200 feet (61 m) wide. The pyramids and plazas of Teotihuacán in the Valley of Mexico might appear on such a map, but certainly the types of minute archaeological distribution information that the average survey seeks would not. The latest high-resolution images pick up features only 90 feet (27 m) wide, although the French SPOT satellites can work to a resolution within 8 feet (2.5 m).

Computer-enhanced LANDSAT and SPOT images can be used to construct environmental cover maps of large survey regions that are a superb backdrop for both aerial and ground survey for archaeological resources. Recently, NASA's World-Wind satellite imagery and other government sources have become available on the Web, as has GE, which, like World-Wind, provides dynamic imagery and a good search tool, a mosaic of photographic images laid over 3-D landscape models that provide a topographic backdrop. Unfortunately, only larger cities are covered at high resolution, such as would be useful for archaeology (Bousman, 2006). Corona and Ikonos satellite imagery also hold promise. (See the chapter-opener photo on page 126.)

LiDAR The latest remote sensing technology is laser altimetry, usually called **LiDAR** (light detection and ranging), which is the optical equivalent of radar. The airborne LiDAR uses a pulsed laser beam that is scanned from side to side as the aircraft flies over the survey area, measuring up to 100,000 points per second to build an incredibly detailed three-dimensional digital model of the landscape and its features. These terrain models are incredibly useful for identifying archaeological features, including those that are virtually invisible to the naked eye. Even buried features can be identified. Since the latter cause changes in the vegetation or soil moisture content, they affect the amount of absorption and reflection of the laser beam, thus allowing their detection. Likewise, terrain that is obscured by dense jungle, or protected vegetation, can also be efficiently mapped, as has been the case for the large-scale mapping around Angkor Wat (see the Doing Archaeology box). Given the accuracy and speed of data capture, LiDAR—while still an expensive undertaking—is far more cost-effective than traditional survey methods. Fieldworkers across the world are now carrying out important LiDAR surveys, from the pre-Classic Maya

settlement at El Mirador, Guatemala, to the pioneering survey of the grounds of the colonial Wye Hall Plantation, near Chesapeake Bay in the United States, once owned by William Paca, governor of Maryland, and one of the signatories to the Declaration of Independence.

Doing Archaeology Using LiDAR at Angkor Wat, Cambodia

The stupendous temple of Angkor Wat and its densely forested environs are currently the focus of a major project involving LiDAR laser scanning. The results are transforming our understanding of the site and how it worked (Fletcher et al., 2015).

Angkor Wat in Cambodia, with its iconic lotus bud towers, was built at the zenith of the Khmer Empire during the reign of its ambitious leader, Suryavarman II (A.D. 1113–1149). While the temple has been the focus of research for over a century, over the past 20 years, archaeologists have sought to understand more about the temple and its wider landscape, initially through a series of remote sensing projects and extensive fieldwork—begun by Christophe Pottier and expanded by Roland Fletcher and Damian Evans.

Their work revealed that the moated temple complex of Angkor Wat originally stood near the middle of the huge, low-density, urban settlement (labeled “Greater Angkor”), which covered roughly 1,000 km² and contained an estimated 750,000 inhabitants. However, the dense Cambodian forest hampered these surveys, especially around Angkor Wat itself, which lies at the heart of the protected Angkor World Heritage Archaeological Park (see [Figure 8.8](#)). In 2012, working for KALC (the Khmer Archaeology LiDAR Consortium) and in collaboration with Tan Buon Suy of the APSARA National Authority (the Cambodian body responsible for Angkor), Damian Evans and Roland Fletcher launched a cutting-edge project using airborne LiDAR. This remote work allowed them to discover more about the temple itself and to “see” through the surrounding jungle. The results have rewritten all that we thought we knew about the site and its wider region.

At Angkor Wat itself, the aerial LiDAR survey demonstrated that the temple complex was far larger and far more complicated than had previously been imagined (Fletcher et al., 2015). In addition to the

temple's huge main moated central enclosure, LiDAR identified a large eastern extension—perhaps an admin or living zone—together with a strange area to the south of the moat, consisting of four large blocks, which may be the remains of raised fields, or perhaps even ornamental gardens. Surrounding the great temple itself, LiDAR further revealed a formal grid of roads, mounds, and associated small ponds typically 60–98 feet (20–30 meters) across and probably originally used for drinking and washing).

Meanwhile, outside the temple complex, LiDAR mapped the true extent of a “mega city” in the jungle, which was clearly connected to Angkor Wat via a road grid that originated at the site and stretched into its sprawling suburbs (Evans and Fletcher, 2015). This work upended the long-held dichotomy of Khmer holy city/outlying countryside. Instead, it showed how the whole wider area was as urban as the central area—that the whole of Greater Angkor should be regarded as “the city” (a little like New York City's relationship to the central urban area of Manhattan with St Patrick's Cathedral, or as Greater London is to its central “City of London” with its St Paul's Cathedral).

As well as revolutionizing our understanding of the scale, splendor, and complexity of Angkor Wat, the ongoing LiDAR surveys have transformed our understanding of the entire region of Angkor—revealing it to be a vast and interconnected urban landscape. Using LiDAR is still expensive and fine-grained research, but this project epitomizes the future of field research in archaeology (Fagan and Durrani, 2016).

Recording Archaeological Sites

Once sites have been identified, whether by field survey or satellite imagery, their location, features, and extent are carefully recorded. These data can be used to address various research questions or CRM concerns. For example, studies of changing settlement distributions plotted against environmental data provide significant information on changing human exploitation of the landscape (see [Chapter 15](#)). Thus, recording the precise global location of archaeological phenomena revealed by a survey is of high priority.

Information on site location can be recorded in a variety of ways. It

is not enough just to record the precise latitude, longitude, and map grid reference. Special forms are used to record the location of the site, as well as information about surface features, the landowner, potential threats to the site, and so on. Every site in the United States is given a name and a number. Sites in Santa Barbara County, California, for example, are given the prefix CA-SBa- and are numbered sequentially. So many sites are now known in North America that most states and many large archaeological projects have set up computer data banks containing comprehensive information about site distributions and characteristics. Arkansas, for example, has a statewide computer bank that is in constant use for decisions on conservation and management.

Maps

Maps are a convenient way of storing large quantities of archaeological information (Howard, 2007). Mapping specialists, called cartographers, use many methods to record and communicate information graphically, devices that are very useful inclusions in archaeological reports. Sites may be recorded at different scales depending on their size and location, and different features or phenomena may be highlighted. Large archaeological sites such as road systems or major settlements can sometimes be easily plotted using aerial photographs and placed on large-scale maps, but very small phenomena such as artifact scatters or middens are generally impossible to find on even the most detailed maps. Traditionally, recording was done entirely by hand, but the increasing availability of a variety of computer mapping programs has facilitated both site recording and data storage.

Topographic Maps Distributions of archaeological sites are usually plotted on large-scale **topographic maps** that relate the ancient settlements to the basic features of the natural landscape, such as hills, valleys, mountains, and rivers, as well as settlements, roads, railroads, quarries, and trails. Topographic maps indicate elevation by concentric lines that provide the experienced surveyor with a detailed idea of the survey areas terrain. These base maps can then be overlaid with plots that show vegetation cover—either prehistoric or modern—and soil types, site distributions, and even prehistoric trade routes.

Global Positioning Systems An important advance in recent years has been the advent of low-cost GPS, which locates sites using satellite positioning systems. Handheld GPS units can be used in a variety of environmental settings and enable fieldworkers to locate sites within a few feet. They are especially advantageous in settings where roads and other identifiable features are limited, or where vegetation makes plotting sites on topographic maps challenging. With larger regional investigations, and extensive CRM projects, especially in the western United States, remote sensing and GPS are used to record and manage archaeological sites (see [Chapter 18](#)).

Site Plans Site plans are specially prepared maps made by archaeologists to record the provenance of artifacts, food residues, and features present at an archaeological site. Site plans are keyed to topographic and other survey information from a carefully selected, fixed point called a **datum point**. A datum point is usually located on a prominent feature, such as a survey beacon, structure, or survey marker that appears on a large-scale map, but it may also be fixed by GPS. The datum point provides a reference from which a grid of squares can be laid over the area of the site, normally open-ended so that it can be extended to cover more ground if necessary. A site grid is critical for recording surface finds and, during excavation, for use in 3D recording (see [Chapter 9](#)).

Planimetric Maps In addition to site plans, a variety of more specialized maps are used to record archaeological data. On large sites, structures and monumental architecture may be plotted on **planimetric maps**, which relate different archaeological features to one another and contain no topographic information (see [Figure 8.9](#) [right]). Idealized reconstructions of a site's principal features may be shown to provide a graphic representation of what the site may have looked like.

The Geographic Information System

Distribution maps have been part of archaeology for generations but, in themselves, they are little more than clusters of dots on maps, perhaps with topography added. Many early maps reflected the distribution of archaeologists and their finds rather than the true density of sites across

the landscape. **Geographic information system (GIS)**, a technology that appeared during the 1980s, has revolutionized the storage and display of cartographic data, including archaeological sites (Conolly and Lane, 2006). You can now view archaeological sites in all kinds of geographic contexts simply by pressing a few computer keys—to the point that you can even sometimes look at sites against the topography and vegetation of the day. GIS comprises three elements: a powerful computer graphics program that draws the digital map, one or more external databases linked to the items on the map, and a series of analytical tools that interpret and statistically analyze the stored data in graphic form. As a long-term project, most U.S. states are putting their databases of archaeological sites on GIS, using U.S. Geological Survey topographic maps, which are available in digital form.

We always think of GIS in terms of layers, the basic layer being the topographic map, to which you add layer after layer of information such as vegetation, water sources, archaeological sites, and so on, preparing a map that can display all kinds of different information, which can be changed at will. The metaphor is a base map, upon which you pile layers of tracing paper or transparent plastic that display different kinds of data. With GIS, you use a georeferenced database, where all the data, be it about soils or sites, is recorded using the same mapping system. Each data point has its own database, where information such as artifact frequencies, unusual finds, and so on is displayed, to say nothing of architectural features, storage pits, or contour lines. In short, the past is at your fingertips, and in such a format that you can ask questions of your map. How far away from a specific village were acorn-rich oaks to be found? What food resources and toolmaking materials lay within 3 miles (5 km) of the settlement? How far did people have to walk to reach the best soils for cultivating maize? You can even bring up the landscape in such a way that you can see the same view as the ancient inhabitants saw, an important strategic concern when you are afraid of raiders or surprise attacks from the sea. GIS does what archaeologists have done for generations—look at sites in the context of their environment—but it does it in a fraction of the time that it used to take. And after the databases are constructed—an extremely lengthy process but one that makes sense when you are concerned with inventorying sites and predictive surveys—it does it

with far greater sophistication and precision (Gillings and Wheatley, 2005).

GIS, Viewpoint Analysis, and the Onondaga

Many factors affect patterns of human settlement—water supplies, arable land, firewood, and basic raw materials, to mention only a few. All these are quite apart from political, social, and even ideological considerations.

For the past century-and-a-half, archaeologists have studied the changing settlement patterns of the Five Nations Iroquois in northeastern North America, research that has produced an almost unrivaled amount of basic data. An innovative GIS study has used what is called **viewshed analysis**, looking at settlement patterns by calculating the potential visibility of different locations within a closely defined grid laid over the landscape (Jones, 2006). Viewshed analysis has been used with success on hillforts dating from Neolithic to Iron Age times in southern Britain. The researchers found that the viewsheds of hillforts decreased through time and became more focused on economic holdings. In southeastern Alaska, Herbert Maschner (1996) examined the factors behind settlement patterns where a wide variety of sites were involved. Environmental variables such as beach quality, climatic exposure, and island size radically affected site distribution, but the defensibility of sites became increasingly important over time. It was this factor—defensibility—that interested Eric Jones in his study of Late Woodland and early Historic Periods in northeastern North America.

Iroquois settlements moved every 20 to 30 years, with village members constructing a new community within a few miles of the original location (see Figure 8.12). The transition took several months and involved everyone moving, family by family, to the new site. Everything was carefully planned. The people would go so far as to prepare fields at the new location long before the move. Jones's study began with villages dating to the sixteenth century A.D. , a time when settlements became larger and were often placed on hillsides and hilltops, where soils were of slightly lower quality. But the factors determining where villages were built are still little understood.

Iroquois communities tended to settle near wetlands and swamps, or rivers and springs, close to places where there were stands of younger growth trees best suited for building materials. However, by the sixteenth century, warfare was endemic and people spent more time and energy building larger and better-fortified villages. This was the period when the famed League of the Iroquois was formed in an effort to reduce tensions between different groups. Late Iroquois groups tended to place their settlements with an eye to two basic needs—the proximity of fertile soils and protection from enemies.

Many factors were involved in selecting a good defensive site. Hilltops or locations surrounded by water such as lake promontories were obvious strategic places. Stockades and fortifications sometimes encircled entire villages. Then there was the issue of line of sight with neighboring communities, so that one could summon aid quickly when one was attacked. Jones mapped the positions of 13 Onondaga sites dating from A.D. 1500 to 1700 as part of a much larger Iroquois settlement-pattern study. The mapped sites were a continuous sequence of about 150 years of settlement, offering an excellent opportunity to study the impact of warfare on Iroquois settlement using viewshed analysis. He located each site with information from previous archaeological surveys and recorded their positions with a GPS instrument accurate to within 9.8 feet (3 m). Then he found a spot on the site boundary that seemed to have the best view of the surrounding countryside. Back in the laboratory, he used the coordinates from the GPS survey as a database, which he combined with digital elevation data obtained from a U.S. Geological Survey clearinghouse. Using spatial analysis tools in a GIS program, he analyzed the 13 Onondaga sites chronologically, using their founding dates as known from previous research. (Abandonments took place over a period of time and were too imprecise.)

Jones was working with Onondaga sites that all lay on low hills or hillsides, where the farmers could count on more frost-free days. Higher summits might have offered the best defense but a shorter growing season. He found that none of the thirteen sites had a commanding view of the landscape. Almost all of them had significant blind spots. Many had views that only extended into a stream valley. Palisades fortified most of the sites; the viewshed analysis showed that

a number of them maintained what Jones calls “mutual visibility” with their neighbors. Seven villages had line of sight with their contemporaries; two others were less than a mile apart and had viewsheds that covered their neighbor. Only two settlements, both dating to A.D. 1500, were invisible from each other and were located far apart. In such unsettled times, one would assume that new settlements replacing older ones would be visible to each other, if for no other reason than the length of time involved in the move. But only four sites could see their successors, for reasons that still defy explanation.

The Jones viewshed analysis uses GIS data on elevation, but it should be remembered that the entire area was heavily forested in ancient times. This would have severely affected visibility outside the 20-foot (6-m) defensive palisades, which themselves would have impeded the view. The Iroquois did clear areas around their villages and their fields, and tall trees or platforms built on palisades, known from ethnohistoric accounts, could have served as signaling points along lines of sight.

The Onondaga GIS survey suggests that communication between villages and defensive needs may have been important factors in Iroquois settlement patterns. The people were concerned with defense and a need to maintain mutual visibility with neighbors for ease of communication. Mutual defense is, after all, an effective way of producing a much larger defensive force in short order. In the final analysis, of course, viewshed analysis is only part of the picture, but is effective when combined with other environmental and settlement data. But enough is known from this interesting survey to establish that these Onondaga settlements combined a basic requirement for productive soils with the pressing needs of defense.

Generations of archaeologists and historians have commented on the violent conflict that marked Iroquois life during these centuries but, until now, we knew little about how the people balanced agriculture with warfare. This survey shows that they paid attention to local microclimates and defense in choosing village sites. The Jones survey is just a preliminary analysis, but it offers a blueprint for larger-scale research in the future and shows how well-designed GIS surveys can take the archaeologist beyond simplistic environmental and economic analyses into the realities of daily life as imprinted on the landscape.

S i T E > Teotihuacán, Mexico <

Perhaps the largest site-survey project ever undertaken was the Teotihuacán Mapping Project directed by George Cowgill and René Millon. Teotihuacán lies northeast of Mexico City and is one of the great tourist attractions of the Americas. This great pre-Columbian city flourished from about 250 B.C. until A.D. 700. Up to 150,000 people lived in Teotihuacán at the peak of its prosperity. Huge pyramids and temples, giant plazas, and an enormous market formed the core of the well-organized and well-planned city. The houses of the priests and nobles lay along the main avenues; the artisans and common people lived in crowded compounds of apartments and courtyards.

Cowgill and Millon realized that the only effective way to study the city was to make a comprehensive map of all of the precincts; without it, they would never have been able to study how Teotihuacán grew so huge (Cowgill et al., 1984). Fortunately, the streets and buildings lay close to the surface, unlike the vast city mounds of southwestern Asia, where only excavation yields settlement information.

The mapping project began with a detailed ground survey, conducted with the aid of aerial photographs and large-scale survey maps. The field data were collected on 147 map data sheets of 1,640-foot (500 m) squares at a scale of 1:2,000. Intensive mapping and surface surveys, including surface collections of artifacts, were then conducted systematically within the 8-square-mile (20 sq. km) limits of the ancient city defined by the preliminary survey. Ultimately, the architectural interpretations of the surface features within each 1,640-foot (500 m) square were overprinted on the base map of the site. These architectural interpretations were based on graphic data and surface data collected on special forms and through artifact collections, photographs, and drawings. Extensive use of sophisticated sampling techniques and quantitative methods was essential for successful completion of the map.

By the end of the project, more than 5,000 structures and activity areas had been recorded within the city limits. The Teotihuacán maps do not, of course, convey to us the incredible majesty of this remarkable city, but they do provide, for the first time, a comprehensive view of a teeming, multifaceted community with vast public buildings, plazas, and avenues, where thousands of small apartments and courtyards formed individual households and workshops for production of pottery,

figurines, and obsidian items. The survey also revealed that the city had been expanded over the centuries according to a comprehensive master plan. (For more on Teotihuacán, see [Chapter 15](#).)

Assessing Archaeological Sites

Archaeological surveys are designed to solve specific research problems or to address cultural-resource-management concerns. Once sites have been located, they are carefully surveyed and the data are recorded. Site survey includes the mapping of archaeological features, as well as the collection and assessment of surface material recovered (see the earlier Site box). These data are used to provide an evaluation of the archaeological site's age, significance, and integrity. Site survey has the following specific objectives in mind (Hester et al., 2008):

- To collect and record information on subsurface features, such as walls, buildings, and fortifications, traces of which may be detected on the surface. Such features may include ancient roads, agricultural systems, and earthworks, which are first detected from the air and then investigated on the ground.
- To record and collect information on artifacts and other finds lying on the surface of the site.
- To use both of these categories of data to evaluate the age, significance, and function of the site (see the Site box discussed earlier).

Site survey has the great advantage of being much cheaper than excavation, provided that the methods used are based on explicit research designs. Many of the most exciting recent studies of cultural process and changing settlement patterns have depended heavily on archaeological survey and site survey. The large-scale field surveys around the Maya city of Copán have used remote sensing, field survey, and obsidian hydration dating to chart changing settlement patterns before and during the collapse of Maya civilization (Freter, 1993). The data from the survey show a concentration of population in the urban core during the height of Classic Maya civilization, followed by a slow dispersal into rural communities, which caused the environment to

become overexploited at the time of the collapse.

Surface Collections

The artifacts and other archaeological finds discovered on the surface of a site are a potentially vital source of information about the people who once lived there. Surface finds are often the first materials examined from a site and, consequently, frequently provide preliminary information on the age, cultural associations, and types of activities represented. Surface collection has these objectives (Hester et al., 2008):

- To gather representative samples of artifacts from the surface of the site to establish the age of the area and the various periods of occupation.
- To establish the types of activity that took place on the site.
- To gather information on the areas of the site that were most densely occupied and that might be most productive for either total or sample excavation.
- To locate major structures that lie, for the most part, below the surface.

Some archaeologists distrust surface collection, arguing that artifacts are easily destroyed on the surface and can be displaced from their original positions by many factors. But this viewpoint neglects a truth: All archaeological deposits, however deep, were once surface deposits, subject to many of the same destructive processes as those resting on the surface today (Dunnell and Dancey, 1983). Experiments have shown that even more than a century of cultivation may scatter artifacts over no more than a radius of 20 feet (6 m). This relatively small “halo” area makes total collection feasible, especially for small hunter-gatherer settlements.

Surface levels contain abundant information about artifact patterning if one can separate cultural patterns from those caused by natural formation processes that have occurred since the site was abandoned. With the increased emphasis on regional surveys and settlement archaeology in recent years, many fieldworkers have demonstrated that surface deposits can provide much information on artifact distributions and other phenomena found underground. This is provided, of course,

that they have not been subjected to catastrophic industrial activity, strip mining, or other drastic alteration from natural weathering, erosion, and rainfall.

Natural processes and human activity may result in the pulverizing of potsherds, stone tools, and bone fragments. But surface data have two major advantages: They are a body of information that can be obtained on a regional scale, not site by site, and the cost of obtaining the data is but a fraction of that for excavation. Increasingly, archaeologists are thinking of surface data as primary archaeological information essential to understanding regional prehistories. There are various ways of collecting artifacts from the surface of a site, but the process is always carefully controlled, and the provenance of the finds is plotted on a map at the time of collection.

Sampling

Controlled surface collection sometimes involves meticulous recording of all finds, using a grid laid over the surface of the site, an approach especially effective on plowed fields. But as in the case of archaeological survey, surface collections may involve a variety of sampling strategies. Certain areas, representing different time periods, activity areas, or cultural materials, may be selected for collection. One may also collect only diagnostic artifacts, items such as potsherds, stone artifacts, or other characteristic finds that are easily classified and identified. These key finds may enable the archaeologist to assess what periods of occupation, activity areas, or cultural associations are represented at the site.

A common controlled surface collection method involves random sampling. Because total collection is impossible on sites of any size where surface finds are abundant, some type of sampling technique is used to obtain a random sample of the surface artifacts. One often used random-sampling approach involves laying out a grid of squares on the surface of the site and then collecting everything found in randomly selected units. Once such a controlled collection has been made, the rest of the site is covered for highly diagnostic artifacts. Rigorous sampling techniques are essential to obtain even a minimal sample of finds at the individual site level. Surface collection and sampling are often

combined with systematic, small test-pit excavations to get preliminary data on strati-graphic information.

Subsurface Detection

Evidence of the past activities of a region's inhabitants can be obtained from surface collections, but only when the relationship between remains found on the surface and present below the ground is clearly understood. Sometimes the surface finds may accurately reflect site content; at other times they may not. It is reasonable to assume that, on shallow sites, such as many prehistoric settlements in the American West, the artifacts on the surface accurately reflect those slightly below the ground (Millon, 1973). This assumption provides a basis for studying activities from surface finds. In other cases, natural processes and cultural factors impact the integrity and the depth of archaeological deposits. Obviously, almost no finds from the lowest levels of a 30-foot-deep (9 m) village mound will lie on the surface today, unless erosion, human activity, or animal burrows bring deeply buried artifacts to the surface. In any case, the conclusions derived from any surface collections must be verified by excavation.

Because archaeological remains may lie deeply buried below ground surface, determining the presence of archaeological resources and site assessment must rely on some type of subsurface testing or evaluation. These include methods from nonintrusive methods, which do not affect subsurface remains in any way, to increasingly intrusive techniques like excavation and subsurface testing.

Nonintrusive Methods

Every archaeologist dreams of a way of exploring sites without the labor of excavating them. Some subsurface detection methods are very simple, but most are expensive, and some are very time consuming. Many of the more sophisticated techniques were originally developed for oil or geological prospecting (Clark, 1997; Hester et al., 2008). These methods can sometimes save many weeks of expensive excavation and, on occasion, can aid in formulating an accurate research design before a dig begins.

Bowsing In this low-tech, nonmechanical method, the surface of the site is thumped with a suitable heavy pounder. The earth resonates in different ways, so much so that a practiced ear can detect the distinctive sound of a buried ditch or a subsurface stone wall. Bowsing, more an art than a geophysical method, really works—with practice. In particular, features such as buried walls may be identified in this way.

Resistivity Survey The electrical resistivity of the soil provides some clues to subsurface features on archaeological sites (Leute, 1987). Soils vary in their ability to conduct electricity, mainly because the different soils or structural features have varying moisture containing mineral salts in solution. For example, clay soils provide the least resistance to current flow; sandy soils provide much more resistance. A resistivity survey meter can be used to measure the variations in the resistance of the ground to an electrical current. Stone walls or hard pavements retain less moisture than a deep pit filled with soft earth or a large ditch that has silted up. These differences can be measured accurately so that disturbed ground, stone walls, and other subsurface features can be detected by systematic resistivity survey. Surveying a site requires only the resistivity meter, which is attached to four or five probes. A grid is laid over the site, and the readings taken from the probes are plotted as contour lines. These show the areas of equal resistance and the presence of features such as ditches and walls. This method was employed by one of us (Nadia) during research into a series of First World War sites just outside London, where the team was able to trace buried features such as the former (ditched) run between the gun emplacement site and a likely ammunition dump (Faulkner and Durrani, 2008). This technique was also used to identify subsurface features at the late Woodland and early Historic Howorth-Nelson site in southwestern Pennsylvania (Adovasio and Carlisle, 1988; see [Chapter 18](#)).

Magnetic Survey Variation in magnetic fields is used to find buried features such as iron objects, fired clay furnaces, pottery kilns, hearths, and pits filled with rubbish or soft soil (Leute, 1987). The principle is simple: The subtle variation in the magnetic fields of buried materials is used to identify archaeological features. Rocks, boulders, and soil will acquire magnetism if iron oxides are present when they are heated.

Any mass of clay heated to about 1,292°F (700°C) and then cooled acquires a weak magnetism. When the remnant magnetism of fired clay or of other material is measured, it will give a reading different from that of the intensity of the earth's magnetic field normally obtained from undisturbed soils.

The proton magnetometer is the instrument most commonly used to magnetically detect archaeological features. A site is surveyed by laying out 50-foot-square (15 m sq.) units, each divided into a grid of 5-foot (1.5 m) squares. The measurement is taken with a staff, to which are attached two small bottles filled with water or alcohol enclosed in electrical coils. The magnetic intensity is measured by recording the behavior of the protons in the hydrogen atoms in the bottle's contents. The magnetometer itself amplifies the weak signals from the electrical coils. Features are traced by taking closely spaced measurements over areas where anomalies in the magnetic readings are found. Computers record the field data and convert them into a display on a television screen or a printout. Sophisticated software allows the operator to screen out nonarchaeological variation in soil magnetism. **Magnetometer surveys** have been used successfully to record pits, walls, and other isolated features in the middle of large forts or plazas, where total excavation is clearly uneconomical. This method has been used widely in Europe—for example, with the recent headline-grabbing discovery of the largest Neolithic village ever found in Britain, just outside Durrington Walls, part of the great ritual complex around Stonehenge (Parker Pearson, 2006). There, the team identified around 25 houses in magnetometer survey (see also [Chapter 17](#)). This technique has also been used on Olmec pyramids at La Venta, Mexico. However, it is subject to some error because of interference from such modern features as barbed wire fences, electric trains, and power cables. Fortunately, some features such as shallow graves or pits have distinctive profiles.

Another electromagnetic device that is increasingly used in archaeological digs is the **metal detector**. A development of mine-detecting technology from the Second World War, when they first became cheaply available and the hobby of metal detecting took off in the 1970s, the archaeological establishment was originally almost uniformly hostile toward them (see the Doing Archaeology box on page

150). They work by passing an electrical current through a transmitter coil, which generates an alternating magnetic field. Buried metal objects distort this field, and are detected when a receiver coil picks up an electrical signal.

Ground-Penetrating Radar (GPR) Magnetic and resistivity surveys are somewhat crude. In recent years, **ground-penetrating radar** has come to the fore as a major instrument for nonintrusive archaeology, especially in CRM work. GPR reflects radar waves off subsurface features by propagating distinct pulses of radar waves from a surface antenna. The velocity of the radar waves depends on the electrical and magnetic properties of the soil through which they are passing. When the travel times of the pulses are measured and their velocity through the ground is known, then the depth of a feature below the ground can be measured accurately.

Early GPR units were cumbersome but have become much lighter and can be loaded into several backpacks and taken to remote locations. Most systems can be powered from car batteries or portable electrical generators. Some of the latest generation of machines are even powered by small rechargeable batteries. The same machines allow immediate computer processing of the data in the field. Although much depends on mineralogy and ground moisture, modern computer enhancement tools allow GPR to be used even in seemingly unfavorable situations.

When using GPR, the operator moves the antennas along the ground. Two-dimensional profiles of a large number of reflections are produced along lines, creating a profile of subsurface stratigraphy and buried archaeological features. The data are acquired in a series of transects within a site grid; the reflections are then correlated and processed, which results in an accurate three-dimensional picture of buried features and their stratigraphy (for an excellent discussion, see Conyers and Goodman, 1997). Anomalies spotted by GPR can be plotted with good accuracy, and pits as small as 12 inches (30 cm) in diameter and 4 inches (10 cm) deep have been located. Individual metal objects can also be detected using this method, which holds great promise for the future.

Intrusive Subsurface Testing

In many instances, equipment such as a magnetometer may not be

available or is unsuitable for particular local conditions. Also, data from magnetometer or resistivity surveys must be verified and evaluated against the archaeological record. Consequently, most archaeological surveys and site assessments incorporate some limited subsurface testing. It is incorporated into the research design and carried out following a specified pattern.

Techniques used range from the very simple to increasingly sophisticated methods and substantial excavation. For example, a simple probe, consisting of a solid metal rod welded to a T-bar handle, may be stuck into the ground at intervals to determine if buried features or walls are present (Nöel Hume, 1983). The amount of resistance encountered or the sound made by the probe scraping against artifacts may help determine the presence of buried features. On the other hand, archaeologists evaluating buried tombs or the interiors of monuments have also used sophisticated periscopes and robot-guided video cameras. (Think of the technology used to inspect sewer lines.) In some cases, earthmoving equipment such as backhoes must be used to determine if cultural materials lie buried beneath thick layers of sterile alluvial soil in river basins.

Doing Archaeology Metal Detectors, the Staffordshire Hoard, and the United Kingdom's Portable Antiquities Scheme

In July 2009, Terry Herbert was out metal detecting when he literally struck gold. Herbert had discovered the biggest cache of Anglo-Saxon gold ever discovered in Britain. The only other find that comes close in significance is the famed Sutton Hoo treasure uncovered some 70 years before.

Found in the Central England county of Staffordshire, the eponymous hoard (sometimes also known as the Ogle Hay Hoard) comprises more than 3,500 pieces of gold and silver. This roughly doubles the total quantity of metalwork known from this period of Anglo-Saxon history. The workmanship and materials are consistently of the highest quality, and their aesthetic beauty has inspired awe among even the most hardened archaeological veterans. Though still in the initial stages of study by archaeologists, the hoard is poised to redefine understandings of Anglo-Saxon society, politics, and thought

(Figure 8.8).

The assemblage consists almost entirely of military artifacts including precious metal and garnet-inlaid sword hilts, pommels, helmet fragments; also of note are three objects of Christian significance, including a strip of gold bearing the biblical inscription “Rise up, Oh Lord, and may your enemies be dispersed and those who hate you be driven from your face,” which may have been worn when charging into battle.

Some objects are without known parallels. Most items appear to have been damaged prior to deposition. It is possible that they were intentionally broken and folded in order to compress them for carrying. The gold had been bent, twisted, and sometimes broken. The silver, less malleable, had usually been broken, and generally survived more fragmented than the gold. The hoard is also oddly unbalanced. Expected objects, such as the buckles and dress fittings worn by the men who carried these weapons, are absent, as are feminine dress fittings, which are otherwise not uncommon. But most striking is the absence of any iron sword blades. These would have had fine, pattern-welded blades and were treasures in their own right. Why are they not here? Whatever the answer, the material in the hoard appears to have been carefully chosen and was unlikely to have been mere goldsmith’s “scrap” (as has been mooted by some).

Interpretations of the meaning of the hoard are partly informed by contemporary literature, notably the epic poem *Beowulf*, which refers to the burial of a king and the deposition of “useless” gold in his grave, to quote: “They let the ground keep that ancestral treasure, gold under gravel, gone to earth, as useless to men now as it ever was” (Heaney, 1999: 213). Might the hoard represent an offering to the deity of the richest material, and that its broken condition may have rendered it symbolically fit to pass to “the other side”? As for their date, this, too, is the source of much debate, with Carver (2011) suggesting they were feasibly made from the late sixth into eighth century A.D. , while archaeologist, Kevin Leahy (see later), prefers an older date range of circa A.D. 600–700.

That this remarkable hoard became known to archaeological scholarship is testimony to the integrity of its finder, Terry Herbert, and the success of the UK’s innovative Portable Antiquities Scheme (PAS).

Herbert had been a hobby metal-detectorist for 20 years, ever since buying a machine in a car-boot sale. After his electromagnetic device started humming wildly, he dug down. To his astonishment he discovered gold. He worked feverishly for five days after recovering the first object. As the significance of his discovery dawned on him, he contacted the local Finds Liaison Officer for the PAS, Duncan Slarke, who promptly visited him to receive no fewer than 231 bags of gold objects.

Figure 8.8 Artifacts from the Staffordshire Hoard. The gold band bears a Latin inscription: “Rise up, O Lord, and may thy enemies be dispersed and those who hate thee be driven from thy face.”

Source: Courtesy of Reuters/Eddie Keogh.

Birmingham Archaeology (United Kingdom) were called on to carry out a controlled, and top-secret (to avoid attracting looters) excavation of the hoard find-spot. They were assisted by Anglo-Saxon specialist, the aforementioned Kevin Leahy, who catalogued all the finds onto a database in just 12 days. This allowed a formal inquest to be held, as the law required, within 11 weeks of Herbert’s original discovery. The inquest confirmed that the hoard was technically “Treasure,” according to Britain’s 1996 “Treasure Act” (Leahy et al., 2011).

Its status as “Treasure” meant that the hoard was the property of the state and that interested museums could acquire the material at a full market value. But what was its value? This was objectively established by the Treasure Valuation Committee (TVC). After rigorous consultation with specialist dealers and auction houses, the TVC finally arrived at a figure that was accepted by all parties, finder, landowner, and museums. In this case, Birmingham Museum and Art Gallery and the Potteries Museum and Art Gallery, Stoke on Trent, joined together in an appeal supported and organized by the Art Fund to raise the £3.285 million (over 6 million US dollars) needed to keep the hoard in the area. They were supported by major grants from trusts but, remarkably, an unprecedented £900,000 (almost 2 million US dollars) came directly from members of the public. Under the Treasure Act, the amount was split between the finder and the landowner (Leahy et al., 2011).

Metal detectors have long been controversial in archaeology. This reflects their misuse to vandalize archaeological sites by stripping them of valuable metal objects. In some cases, this was done for personal gain, and the objects themselves were sold and all knowledge of them lost. "Night-hawking" is a major concern of archaeologists. It typically involves nocturnal raids by metal-detectorists on important archaeological sites in order to recover valuable objects for sale on the black market. In other cases, there was no ill intent, but the effect was to remove objects from their archaeological context, greatly reducing their information value even if they were subsequently brought to the attention of appropriate specialists (see later).

Some archaeologists, on the other hand, have always recognized that the great majority of metal-detectorists are neither criminals nor people motivated by personal gain. Their hobby is a way into the past. In the 1970s, some archaeologists, including Kevin Leahy (as above), pioneered the building of working relationships with metal-detectorists in their counties. The idea was to create channels of communication so that finds could be identified, find-spots recorded, and the public store of archaeological knowledge enhanced by the work of the metal-detectorists. Indeed, those metal detectorists working on plough soil were locating archaeology in the top soil that would otherwise not survive the tractor's teeth (in line with most countries, the United Kingdom has experienced a great expansion in agriculture since the 1950s). It was considered that it was imperative that this information be recorded.

The success of these informal arrangements underpinned the drive to create a national scheme in Britain. Two decades later, British Museum archaeologist Roger Bland advised the government on the (new) 1996 Treasure Act and also pushed forward the establishment of a national PAS. The act and the scheme complemented one another, the former providing a new legal framework that safeguarded the interests of finders and gave them an incentive to come forward, the latter creating the local mechanisms for contacting metal-detectorists; winning their confidence; and setting up regular systems for the identification, recording, and cataloging new finds into a database. Once the new Treasure Act was passed in 1996, the PAS was piloted in a number of regions, before going national a couple of years later. Finds liaison

officers (FLOs) are now in place across England and Wales (www.finds.org.uk). The usual pattern is for FLOs to build links with, and make regular visits to, metal-detecting clubs, and in this way create and maintain relationships with local hobbyists. Finds identification and recording are often done on the spot, but if they need to be taken away, this is done only with permission, and all finds are returned. Trust is crucial to the effectiveness of the scheme. The exception is with treasure finds, which are subject to state control, but here the finder's interest in the commercial value of any objects is protected.

However, the controversy over hobbyist metal detecting still rages. For example, with respect to the Staffordshire Hoard, a number of archaeologists expressed grave concerns over how this work was carried out (Webster et al., 2011). Central to their concerns is the lack of information on context. This was partly down to the speed with which the find-spot was formally examined. Much important contextual data have been lost forever, leaving the hoard in something of a vacuum (Carver, 2011). As Carver (2011) further observed: "It seems astonishing that the public presentation of the entire episode was dominated by the reward to an individual rather than the potential reward for this generation, and the many to come, of the new history potentially on offer [had there been a more formal and] structured investigation." Yet while the mode of the discovery has raised regret, all archaeologists (Carver included) acknowledge that without the PAS such a treasure might never have been reported, let alone so promptly announced to the public.

As this Doing Archaeology box illustrates, there are both pros and cons to hobbyist metal detecting. Yet in the final analysis, the UK's scheme has been an incredible success: the PAS has now recorded over 700,000 objects all of which are available on their website www.finds.org.uk. This has resulted in an unprecedented increase in knowledge. Great new light has been shed on many areas of England's past that would otherwise have been lost—whether to farming machinery, to the black market, or simply to the hobbyist's personal collection.

Shovel Test Pits A common method of subsurface testing involves the use of **shovel test pits** (STPs), a technique in which shallow holes of a

proscribed size and depth are made with a shovel. Material excavated from the STPs is typically screened to recover any artifacts, and features or changes in soil color are recorded. STPs are commonly used when large areas need to be tested or when time is short, as in the case of CRM surveys.

The Auger, or Core Borer The auger is a hand-operated or power tool used to bore through subsurface deposits to find the depth and consistency of archaeological deposits. As in the case of STPs, auger samples can recover artifacts and allow for an evaluation of buried deposits to be made. This technique has the disadvantage that the auger or borer may destroy artifacts. Nevertheless, it lends itself to situations where time is limited and large areas are involved.

Augers were used successfully at the Ozette site in Washington to establish the depth of midden deposits (Kirk, 1974). Some specialized augers are used to lift pollen samples. Augers with a camera attached to a periscope head are also used to investigate the interiors of Etruscan tombs (Figure 8.9). The periscope is inserted through a small hole in the roof of the tomb to inspect the interior. If the contents are undisturbed, excavation proceeds. But if tomb robbers have already emptied the chamber, many hours of fruitless labor have been saved.

Examples of Subsurface Detection

Many innovative approaches to archaeological survey and site assessment no doubt lie ahead. For example, Kent Weeks and a team of fellow Egyptologists have embarked on a long-term project to map all of the royal tombs in Thebes's Valley of the Kings. They are using a hot-air balloon, X-rays, and sonic detectors to map subterranean features and hidden chambers in royal tombs; among their discoveries has been a large tomb that once housed Rameses II's sons (Weeks, 1998). The application of radar and other electronic devices is proliferating in archaeology. However, evaluation of an archaeological site typically continues to rely on a combination of methods that may range from the simple to the sophisticated and from nonintrusive remote sensing to subsurface testing.

Cerén, El Salvador The excavations at the Maya village of Cerén in El

Salvador offer an instructive example of coordinated use of innovative geophysical methods to locate subsurface features (Sheets, 2005). The site was buried under up to 16 feet (5 m) of volcanic ash and was first located by a chance bulldozer cut. Obviously, it was uneconomical to bulldoze large areas, so Payson Sheets called in geophysicist Hartmut Spetzler, who analyzed the properties of the volcanic ash at Cerén and of the adobe buildings buried beneath it. There were considerable differences in porosity and density between the ash and the adobe, so Spetzler recommended deploying a portable seismograph, GPR equipment, and a resistivity meter.

Figure 8.9 Etruscan tomb number 5513 of Tarquinia Lazio, mid-fifth century B.C. . Many Etruscan tombs have brightly painted murals. Source: Courtesy of Adam Eastland Art + Architecture/Alamy Stock Photo.

The survey started with the seismograph, which records shock waves passing through the earth. Instead of the usual dynamite, Sheets struck a steel plate set in the soil with a hammer, recording the resulting waves with a set of twelve sensitive microphones. Buried hut floors conducted shock waves faster than the surrounding ash, and the seismograph did indeed locate some structures but, designed as it was for detecting huge geological anomalies, the results were somewhat haphazard. Sheets then turned to GPR, using an instrument developed for studying permafrost melting along the Alaska oil pipeline. Instead of attaching it to a pickup truck, he enlisted the services of an ox cart, which eliminated all background vibration. The ox-cart driver simply drove slowly and steadily along a carefully marked straight line (see [Figure 8.9](#)). The machine itself sent microwave energy deep into the soil and detected it as it was reflected back. The subsurface stratigraphy was recorded on special paper and revealed some strong reflectors, some of which turned out to be the clay surfaces of hut floors covered by ash.

Using a drill rig, Sheets tested some of the anomalies. Some were the result of eroded and redeposited volcanic ash; others were large structures. The radar was still unable to detect smaller features. Resistivity surveys over Cerén recorded the resistance of subsurface deposits to electricity. Sheets expected that house floors would conduct electricity better than the surrounding ash, for they are constructed of dense, fired clay. His researchers recorded measurements along a grid

over the site and fed the data into a laptop computer. The 3-D software revealed interesting double-peaked anomalies, which, when tested with a drill rig, turned out to be large prehistoric structures (see [Figure 8.10](#)). Thus, a combination of geophysical methods provided an effective and economical way to locate subsurface features at Cerén, at a fraction of what it would have cost to bulldoze away acres of ashy overburden.

Doggerland Under the North Sea Investigations at Doggerland offer an instructive example of innovative geophysical methods to locate subsurface features (Gaffney et al., 2009). There, beneath the southern North Sea, across an area roughly the size of New Jersey, lie the hills, plains, and valleys of a Stone Age landscape submerged by floods in an epoch of global warming thousands of years ago. Using new technology, for the first time, archaeologists have now mapped this lost world of the Mesolithic, representing the most-extensive and best-preserved prehistoric archaeology in Europe.

It has long been known that Britain was once joined to the continent and that great floods and inundations over thousands of years gradually eroded away the land bridge until it was finally broken around 6400 B.C. The putative lost world beneath the sea, dubbed “Doggerland,” yielded occasional finds, such as a worked antler point dredged up from peat beds in 1931 by a fishing trawler. So, though Doggerland was known to exist, it was *terra incognita*: the technical difficulty of exploration 164 feet (50 m) beneath the sea, the vastness of the submerged area, the potential cost of investigation, and the uncertainty about whether anything useful would be learned, all combined to prevent systematic research

Figure 8.10 A three-dimensional computer plot of a resistivity survey at the Maya village of Cerén, El Salvador. The anomalies resulting from different electrical resistance show up as sharp peaks (A–E), of which A and B have been investigated and shown to be prehistoric structures.

Recently, however, because the southern North Sea is an economic asset, maritime geophysics has been applied on a massive scale to map the seabed and what lies beneath it. Petroleum Geo-Services donated to a team of archaeological specialists at Birmingham University led by Professor Vince Gaffney (of Stonehenge Hidden Landscapes fame, see

page 133–134) more than 8,500 square miles (22,000 sq. km) of marine seismic data collected and analyzed over decades at a cost of many millions of dollars. The archaeologists were thus able to explore the rivers, streams, lakes, and coastlines of an entire European country that has not been seen for 8,000 years. The team revealed a lost Mesolithic world, its remains pickled in brine, and on a massive scale.

The data were created by equipment carried on ships that generated acoustic pulses capable of passing through different strata and returning with distinct signals. The data were then processed into three-dimensional maps of the geology, accurate to within 41 feet (12.5 m). Traditional deep-sea recording measures only the seafloor, the result of recent scouring and deposition that obscure the prehistoric landscape. The crucial advantage of seismic data is the view through recent sediments to the underlying geology and the sequence of superimposed, ancient landscapes. Work so far has concentrated on mapping the upper land-surface representing Early Mesolithic Doggerland, dated circa 8000–6400 B.C. But the possibility arises that early landscapes might also be mapped, such as that inhabited by the Late Paleolithic hunters of circa 20,000 B.C.

The archaeologists, based at the HP Visual and Spatial Technology Centre at the University of Birmingham, England, have used the seismic data to create virtual reality images of the landscape, brought to life by “seeding” with probable vegetation using an “artificial life engine.” In the first 2,300-square-mile (6,000 sq. km) area studied, for example, they have identified a major river dubbed the “Shotton”—with a width of 1,968 ft (600 m), an observed length of 17 miles (27.5 km), and an associated network of tributaries and wetlands. They then mapped a series of distinct zones over some 8,500 square miles (22,000 sq. km), ranging from marine estuaries and salt marshes, through regions dominated by freshwater river systems and wetlands, to coastal plains and areas of rolling hills.

Rich in flora, teeming with game, Doggerland before the great flood may have been Mesolithic Europe’s Garden of Eden. Systematic survey around the Danish coast—on the edge of Doggerland—has identified over 2,300 prehistoric sites. The team currently hopes to use the information gleaned in order to model where the people may have lived with the idea that they will eventually go back to sea and use modern

coring techniques to see if they can find traces of settlement.

Summary

1. Two interrelated processes are involved in locating archaeological sites: archaeological survey and site assessment.
2. Site survey is concerned with locating and identifying archaeological sites; site assessment evaluates sites in terms of their age, integrity, potential, and cultural affiliations.
3. Many famous archaeological sites, such as the Parthenon, have never been lost to human knowledge. But other less conspicuous locations are only discovered by accident or by planned archaeological survey.
4. Archaeological sites are sometimes identified by features such as mounds, structural remains, or monumental architecture that are prominent on the landscape. Many more features are much less obvious and are located only by soil discolorations or surface finds.
5. Archaeological surveys are done at different levels of complexity, ranging from preliminary reconnaissance surveys leading to the location of only the largest sites to intensive surveys aimed at covering an entire area in detail.
6. In most instances, even an intensive survey may not be able to locate all of the archaeological resources within an area, and all survey is, at best, only a sampling of the research area. Consequently, archaeologists rely on probabilistic sampling methods to obtain unbiased samples of the research area.
7. A battery of new survey techniques are also in use. Some involve aerial photography and remote sensing. Photographs taken from the air can be used to locate sites spread over huge areas. Side-scan aerial radar and scanner imagery from space, as well as satellite imagery, are coming into use. While back on the ground, cutting-edge geophysical equipment currently being tested at Stonehenge—is using gaming technology to produce two- and three-dimensional imagery of the archaeology beneath the earth.
8. Site assessment involves mapping, controlled surface collection,

and subsurface detection methods designed to assess the significance of the site without intrusive excavation.

9. Controlled surface collection is designed to collect and record artifacts and other surface finds. These categories of data are used to test hypotheses about the age, significance, and function of the site.
10. Surface collections may be made by gathering every artifact on the surface of the site, by selecting for diagnostic artifacts, or by random sampling. Surface collections are used to establish the activities that took place on the site, to locate major structures, and to gather information about the most densely occupied areas of the site.
11. GIS and LiDAR technology offer great potential as a way of mapping archaeological data and analyzing them in a wider environmental context.
12. Subsurface features are often detected with subsurface radar and also with resistivity surveys, which measure the differences in electrical resistivity of the soil between disturbed and undisturbed areas. Proton magnetometers are used to locate iron objects, fired clay furnaces, and other features. More controversial has been the (often unregulated) use of metal detectors.

Further Reading

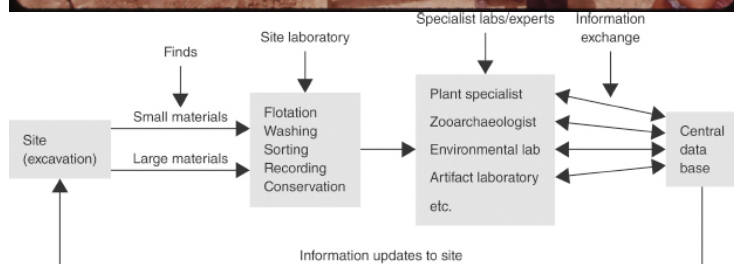
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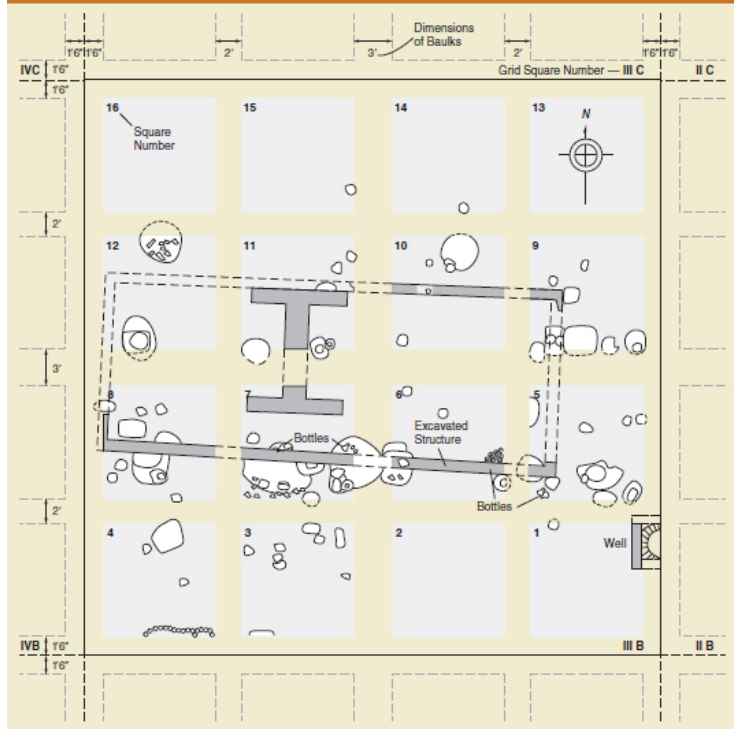
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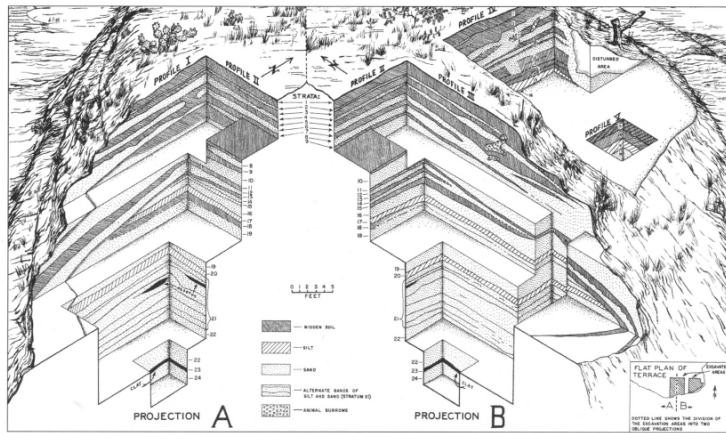




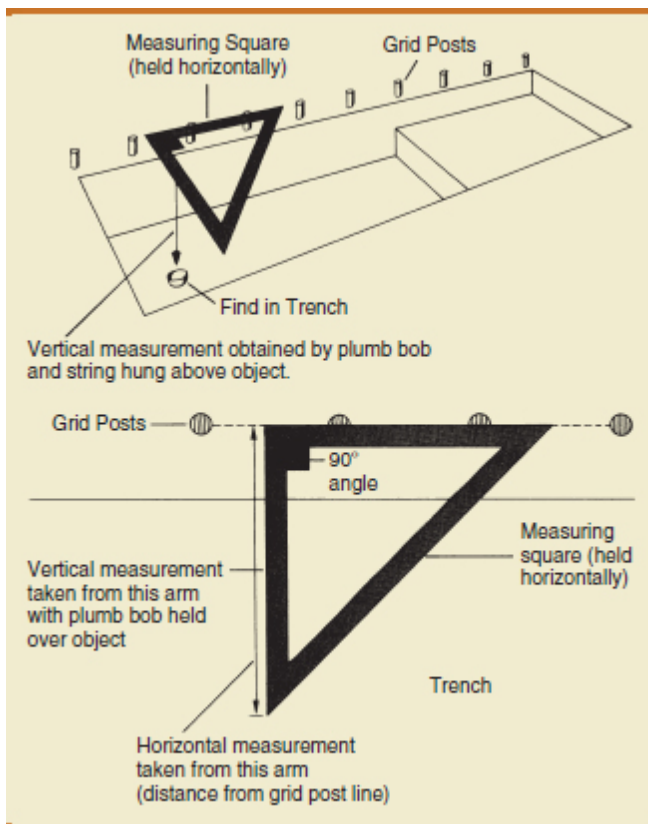




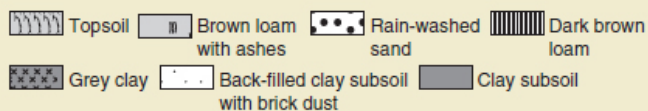
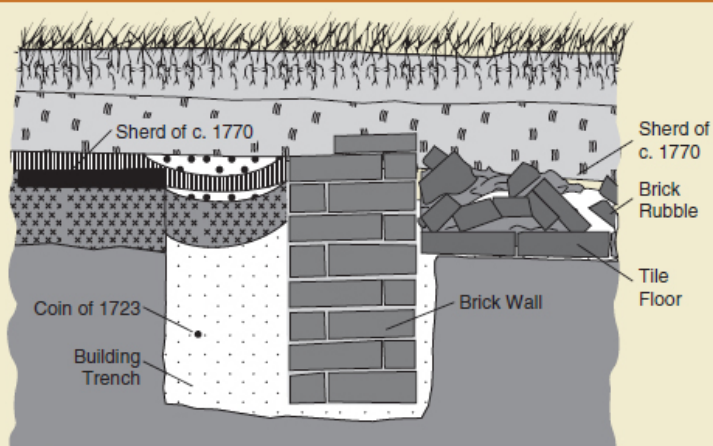














(a)



(b)



9

Excavation

CHAPTER OUTLINE

Organizing Archaeological Excavations

Permits

Planning an Excavation

Dissecting an Archaeological Site

Tools of the Trade

The Process of Archaeological Excavation

Special Excavation Issues

The Maya trading center at Tulum, Mexico, thirteenth to fifteenth centuries A.D.

Source: Courtesy of Chuck Place/Alamy Stock Photo.

The excitement of discovery that comes with excavation is one of the profound pleasures of archaeology. Even the smallest object can spark

deep emotions and provide astonishingly detailed information about the remote past. Mary Chubb, worked at the pharaoh Akhenaten's capital, El Amarna, during the 1930s. A quarter century later, she wrote of the experience:

The wonder of touching something that had lain buried and unmoving for so long came over me... . But I thought of it this way: The little head, wedged in that rubble, up against a ruined wall in this silent, sunny place in Egypt, had been lying there, face downwards, while Troy was burning; while [Assyrian King] Sennacherib was ransacking cities beyond his borders; on through the slow centuries, while the greatness of Athens came and went, and while Christ lived out his days on earth.

(Chubb, 1954: 110)

Excavation! The very word conjures up romantic images of lost civilizations and royal burials, of long days in the sun digging up inscriptions and gold coins. Yet though the image remains, the techniques of modern excavation are far less romantic than they are rigorous, requiring long training in practical field techniques (Roskams, 2001). Unlike reconnaissance and surface survey, excavations recover data from beneath the surface of the ground, where conditions for preservation are best, and accurate information on provenance, context, and association can be recovered intact. Excavation is a creative activity, not just the standardized recording of the archaeological record. It requires constant interpretation, flexible research designs, and an ability to improvise. As the British archaeologist Martin Carver remarks, excavation is “the greatest fun imaginable—exciting, companionable, poetic, like a theatre group, there for each other whether the run is to be long or short” (Carver, 2009: 115). How right he is! A well-run excavation is truly a unique intellectual and social experience.

In this chapter we will discuss some of the basic principles of archaeological excavation: the organization, planning, and execution of a scientific dig.

Organizing Archaeological Excavations

A good director of a modern archaeological field expedition needs skills beyond those of a competent archaeologist. He or she must also be able to fill the roles of accountant, politician, doctor, mechanic, personnel manager, and even cook. Cultural resource management (CRM) project directors also require expertise in compliance with legal requirements (see [Chapter 18](#)). On a large dig, though manual labor may not be the director's responsibility, logistical problems are compounded, and he or she will head a large excavation team of site supervisors, artists, photographers, and specialists (Hester et al., 2008). Above all, the field director has to be the leader of a multidisciplinary team of specialist field-workers (Hodder, 1999).

Multidisciplinary Research Teams

Modern archaeology is so complex that all excavation projects, whether purely academic or CRM, now require multidisciplinary teams of archaeologists, botanists, geologists, zoologists, and other specialists to work together on closely integrated research problems. The team approach is particularly important where environmental problems are most pressing, where the excavations and research seek the relationships between human cultures and the rest of the ecosystem.

A good interdisciplinary or multidisciplinary study is based on an integrated research design bringing a closely supervised team of specialists together to test carefully formulated research questions against data collected by all of them. Notice that we say “data collected by all of them.” An effective multidisciplinary archaeological team must be just that—a team whose combined findings provide an integrated view of a site. This approach is logical, but it is rarely carried to its complete extreme, where the experts design their research together, share an integrated field mission, and communicate daily about their findings and research problems.

The most thorough multidisciplinary excavation must be that at Çatalhöyük, Turkey, where Ian Hodder has embarked on a long-term, university-led research project to investigate this important farming village (see the Site box in [Chapter 3](#) on page 56). He has enlisted a large team of archaeologists from different countries who are using

different approaches to excavation, as well as a small army of specialists in everything from ceramics to zooarchaeology and all kinds of environmental data. Hodder has specialists who are working on communicating the results of the work to the public. This remarkable excavation is based on the belief that the best results in the field come from sustained dialogue between team members and from an integration of theory and observation from the first day of the dig. "Theory begins at the edge of the trowel," Hodder tells us (1999). The Çatalhöyük excavation carries the multidisciplinary approach to extremes by networking all the archaeologists and specialists by computer and requiring them to keep research diaries, which are posted on the Internet and are read by everyone. Possibly the first dig to encourage all of its team members to interact on the social networking site, Facebook; Çatalhöyük originally even had a site biographer, Michael Balter.

Excavation Staff

All excavations are staffed by a director, and most major excavations will involve other specialist experts and several technicians as well. Among the technicians are the following.

Site Supervisors Skilled excavators are responsible for excavating trenches and recording specific locations. The large-scale digs of medieval York in northern England were divided into localities, each with a skilled excavator who supervised the volunteers doing the actual digging.

Recording Experts Some very large excavations will have a full-time surveyor who is responsible for mapping and locating the archaeology. Specialist site surveyors will do nothing but draw and record the stratigraphic profiles and structures found in the dig. (However, it is worth noting that on most digs outside the United States, each excavator is expected to be able to draw and record his or her own excavated features.) Expert archaeological artists and photographers are in great demand, and will take thousands of digital images, slides, and black-and-white photographs during even a short season. Their task is to create a complete record of the excavation from beginning to end

(Adkins and Adkins, 1989; Dorrell, 1994). These days, in conjunction with hand-drawn recording methods, archaeologists also routinely use electronic devices, notably the total station the results of which can then be converted onto a digital record using a drawing package such as computer-aided design (CAD).

Laboratory Staff Even a small excavation can yield a flood of artifacts, and floral and faunal remains that can overwhelm the staff of a dig. A basic laboratory staff to bag the finds and wash, rough-sort, and mark them for eventual transport to the laboratory is vital on any but the smallest excavation. Some knowledge of preservation techniques is essential as well.

Foremen Paid foremen are common on larger Mediterranean excavations. They can become skilled archaeological excavators in their own right, but their primary responsibility is to manage paid laborers. Some devote their entire working lives to archaeology. A century ago, the legendary Near Eastern excavator Leonard Woolley worked for years with Sheikh Hamoudi, a Syrian foreman of brilliant acumen, whose passions were said to be archaeology and violence.

CRM Staff Many CRM projects involve the recording and excavation of sites before destruction (often because the site needs to be cleared ahead of modern building work). Larger CRM organizations in the public and private sectors hire professional excavators, both crew chiefs and excavators, often people with bachelor's and master's degrees in archaeology, to carry out basic labor and more specialized excavation, recording, and laboratory tasks.

This personnel list is ideal and can be found on many well-funded CRM excavations. However, in these days of rising costs and limited budgets, most academic excavations are conducted on a comparatively small scale. A team of students or paid laborers works under the overall supervision of the director and perhaps one or two assistants. The assistants may be graduate students with some technical training in archaeological fieldwork who can take some of the routine tasks from the director's shoulders, allowing him or her to concentrate on general supervision and interpretative problems. But on some sites the director will not only be in charge of the research and arrangements for the

excavation but will also personally supervise all trenches excavated. On that one person, therefore, devolve the tasks of recording, photography, drawing, measurement, and supervision of labor. The director may also take a turn at recovery of fragile burials and other delicate objects that cannot be entrusted to students or workers; he or she is also responsible for the maintenance of the excavation diaries and find notebooks, the storage and marking of artifacts, and the logistics of packing finds and shipping them to the laboratory.

So varied are the skills of the excavator that much of a professional archaeologist's training in the field is obtained as a graduate student working at routine tasks and gaining experience in the methods of excavating and site survey under experienced supervision. For the director, such students provide not only useful supervisory labor but also an admirable sounding board on which to try out favorite theories and discuss in great detail the interpretation of the site. The camaraderie and happiness of a well-run, student-oriented excavation is one of the most worthwhile experiences of archaeology.

Permits

Excavation is a destructive process, which disturbs and modifies an archaeological site permanently. The archaeological record is finite, which means that the global archive of already disturbed and undisturbed archaeological sites shrinks every year. Even as recently as a half-century ago, obtaining an excavation permit was often as simple as receiving a landowner's permission or a generic document specifying the research in general terms from a government agency. Today, the situation is far more complex, for many countries now place all archaeological sites under state ownership, with all the embedded bureaucracy this can entail. In the United States, archaeological sites on private lands receive no legal protection, as they are defined as private property under the Constitution. A rich, intersecting undergrowth of laws and regulations cover archaeological resources of all kinds on federal, state, or Indian tribal lands. Important environmental issues, and even mineral rights, may be at stake. Concerns over sacred places, permanent stewardship of the archaeological record, disturbance of burials, and many other concerns may mean that several local and

national agencies may be involved in a single permit application. Overseas, there may be regulations that require collaboration of local archaeologists, provisions to be made for the final disposal and curation of the finds, and so on. Egypt and Mexico are closely engaged in archaeology and heritage tourism: Such concerns may also affect excavation permits, where the host government may require training of local people, development of facilities for tourism, and so on. In this day and age, no archaeologist digs without a permit or several permits. Obtaining them can be a time-consuming, often frustrating process, especially when there are concerns about preservation of already much excavated deposits, such as Chaco Canyon or Stonehenge. But a carefully formulated, meticulously drafted excavation permit is as much part of a modern-day excavation as a trowel or dental pick.

Planning an Excavation

Excavation is the culminating step in the investigation of an archaeological site. It recovers from the earth data obtainable in no other way (Barker, 1995; Hester et al., 2008; Catling, 2009). Like historical archives, the soil of an archaeological site is a document whose pages must be deciphered, translated, and interpreted before they can be used to write an accurate account of the site's inhabitants.

Excavation is destruction. As the American archaeologist Kent Flannery once wrote: "Archaeology is the only branch of anthropology where we kill our informants in the process of studying them." The archaeological deposits so carefully dissected during any dig are destroyed forever, and their contents are removed. Here, again, there is a radical difference between archaeology and the sciences and history. A scientist can readily re-create the conditions for a basic experiment; the historian can return to the archives to reevaluate the complex events in a politician's life. But all that we have after an excavation are the finds from the trenches, the untouched portions of the site, and the photographs, notes, and drawings that record the excavator's observations for posterity. Thus, accurate recording and observation are overwhelmingly vital in the day-to-day work of archaeologists, not only for the sake of accuracy in their own research, but also because they are creating an archive of archaeological information that may be

consulted by others. The English humorist P. G. Wodehouse once remarked of sightseers watching workers on a construction site: “A mere hole in the ground, which of all sights is perhaps the least vivid and dramatic, is enough to grip their attention for hours at a time.”

Archaeological sites are nonrenewable resources. Thus, unfocused excavation is useless, for the manageable and significant observations are buried in a mass of irrelevant trivia. Any excavation must be conducted from a sound research design intended to solve specific and well-defined problems.

Today, with the past under threat, excavation is the research strategy of last resort.

Research Designs

Research designs are the ever-changing blueprints for all archaeological fieldwork, whether or not one puts a spade into the ground. They are statements of overall and specific questions to be addressed by all stages of the research, sometimes hypotheses to be tested by the fieldwork. Thus, they are of fundamental importance and an essential part of preliminary work. Archaeological excavation is not digging by formula but a carefully managed process that requires constant creative thinking. There are general methodologies for excavation, but the appropriate one varies from site to site and from moment to moment as an excavation proceeds. In a way, excavation is a process of negotiation that balances acquiring the maximum amount of information against potential destruction and the needs of contemporary society. Specific yet flexible research designs are essential (see [Figure 9.1](#)).

Figure 9.1 An urban excavation in the heart of Ghent, Belgium. Saint Nicholas’s Church overlooks excavations of a densely packed precinct, a situation where a flexible research design is essential.

Source: Courtesy of Arterra Picture Library/Alamy Stock Photo.

Both excavation and laboratory work form part of the continuing evaluation of the research design. The large piles of finds and records accumulated at the end of even a small field season contain a bewildering array of interdigitating facts that the researcher must evaluate and reevaluate as inquiry proceeds—by constantly rearranging

propositions and hypotheses, correlating observations, and reevaluating interpretations of the archaeological evidence. Finds and plans are the basis of the researcher's strategy and affect fieldwork plans for the future, the basis for constant reevaluation of research objectives. The need for sound planning and design is even more acute in ecological research in archaeology, in which archaeologists try to understand changes in human culture in relation to human environmental systems. In many respects a research design resembles a business plan—the general blueprint for the investigation.

Just over a decade ago, the National Park Service decided to excavate and stabilize Mound A, a 1,000-year-old Mississippian earthwork once surrounded by a wooden palisade in the Shiloh Mound Complex on the Tennessee River. This meant that the excavators had to balance investigation of the mound and its complex internal structure, revealed by remote sensing, with the need to protect it against the encroaching Tennessee River, which was eroding the archaeological deposits (Walsh, 2005; Anderson, 2002). The research design included a program of dispersed test pits and the excavation of a 2-meter (6.5 foot) wide step trench into two sides and across the top of the mound (Figure 9.2). At the same time, a stabilizing program was put into place, which made assumptions about the amount of loss to be expected over the next half-century. The project, which involved the work of scientists from a wide array of disciplines, posed a number of specific questions to be investigated—mostly to do with the construction of Mound A. But the archaeologists also sought to gain information on the cultural changes, including the possible development of maize agriculture that took place over the site's history. Finally, their plan outlined the stages of fieldwork to be undertaken and the access and safety measures they would implement. Plans were also laid for consultations with the local Chickasaw Nation as excavation proceeded.

Figure 9.2 Excavations at Mound A, Shiloh Mound Complex, Tennessee.

Source: Courtesy of National Park Service.

The Koster Site

The wealth of material at Koster first came to light in 1968 and has been

the subject of very large-scale excavation ([Figure 9.3](#)). Koster lies in the lower Illinois Valley and has a deep accumulation of 26 prehistoric occupation layers extending from about 10,000 years ago to around A.D. 1100–1200 (Struever and Holton, 1979). The dig involved collaboration by three archaeologists and six specialists from other disciplines such as zoology and botany, as well as use of a computer laboratory. Even superficial examination of the site showed that a very careful research design was needed, both to maximize the use of funds and to ensure adequate control of data. In developing the Koster research design, James Brown and Stuart Struever (1973) were well aware of the numerous, complex variables that had to be allowed for. Fortunately, 13 of the Koster cultural horizons were isolated from their neighbors by a zone of sterile slopewash soil, which made it possible to treat each as a separate problem in excavation and analysis—as if it were an individual site—although, in fact, the 13 were stratified one above another. Because the whole site was more than 30 feet (9 m) deep, the logistical problems were formidable, as in all large-scale excavations. One possible strategy would have been to sink test pits, obtain samples from each level, and list diagnostic artifacts and cultural items. But this approach, though cheap and commonly used, was inadequate to the systems model that the excavators drew up to study the origins of cultivation in the area and culture change in the lower Illinois Valley. Large-scale excavations were needed to uncover each living surface so that the excavators could not only understand what the living zones within each occupation were like, but could also, after studying in detail the sequence of differences in activities, make statements about the processes of culture change. Brown and Struever combined excavation and data-gathering activities into a data-flow system (see [Figure 9.4](#)), linking incoming data to computers provided nearly instantaneous feedback to the excavators. The tiresome analysis of artifacts and food residues was completed on-site, and the data were available to the excavators in the field in a few days, instead of months later, as was usual. A combination of instant data retrieval; comprehensive and meticulous collecting methods involving, among other things, flotation methods (see [Chapter 13](#)); these sophisticated theoretical models have made the Koster project an interesting example of effectively used research design.

Figure 9.3 General view of the Koster excavations in southern Illinois.

Source: Courtesy of nsf/Alamy Stock Photo.

Figure 9.4 Data-flow system of the Koster site.

Source: Redrawn from Stuart Struever and James A. Brown, “The Organization of Research: An Illinois Example,” in Charles A. Redman, ed., *Research and Theory in Current Archaeology*, page 128. Copyright © 1971 John Wiley and Sons, Inc. Reprinted by permission of John Wiley and Sons, Inc.

Tremendous advances in computer technology and software since the 1970s, and particularly over the past decade, have made the Koster example look simple compared with even small-scale excavations and surveys today. The advent of the Internet, laptops, and tablet computers has made it easy for excavators to develop on-site networks, to remain in constant touch with laboratories many miles away, to develop digital maps and plans and stratigraphic profiles, and to find location diagrams almost instantaneously. But the Koster dig stands as a fine example of an ideal model.

Dissecting an Archaeological Site

Archaeological excavation balances destruction against acquiring as much information as possible and available funds against the needs of society. When undertaken, its ultimate objective is to produce a three-dimensional record of an archaeological site in which the various artifacts, structures, and other finds are placed in their correct provenance and context in time and space. And when this process is completed, the record has to be published in full for posterity. How, then, do you dissect an archaeological site? Obviously, there is no one standardized way of excavating them, for they vary infinitely in their size, preservation conditions, and complexity (Carver, 2009). Some of the most complex excavations are even conducted underground, such as those in London that take place deep under high-rise buildings or subway stations (see the Site box in [Chapter 7](#) on page 108).

Undisturbed archaeological deposits are so precious and finite that **total excavation** is rare these days. Quite apart from anything else, it is very expensive. Total excavation has the advantage of being

comprehensive, but is undesirable because it leaves none of the site intact for excavation at a later date with, perhaps, more advanced techniques. Total excavation is commonly used on CRM projects when a site is threatened by imminent destruction.

Think about this when you land at London's Heathrow Airport: one of the best examples of total excavation in Britain is the recent work undertaken in advance of the controversial construction of Terminal 5 at London's Heathrow Airport. Between 1996 and 2007, the entire site of the proposed terminal and its ancillary works, covering some 198 acres (80 ha), was excavated in a series of field campaigns. It is reckoned to be the single largest excavation ever to be undertaken in the United Kingdom (Catling, 2011). The work has revealed the slow evolution—over some eight millennia—of a mainly rural southern lowland landscape. By stripping such a large area, it was possible to identify relationships between different sites across the landscape that most smaller (or selective) excavations would simply fail to pick up. For example, along the edge of the floodplain of the River Colne, a tributary of the River Thames, the diggers located a series of simple shallow pits (TL dated) from 6500 B.C. onward. These pits contained burnt flints and appear to have been used for cooking meat. Moreover, it seems that they were visited again and again down the years, conjuring visions of feasting events. Might they have influenced the location of a group of early Neolithic ceremonial monuments dating from circa 4000–3600 B.C. ? Quite possibly.

It was finding these sorts of relationships that was an explicit aim of the research strategy (see the Research Designs section) of this total excavation (Framework Archaeology, 2010). But, as mentioned, to undertake such work requires massive funding—in this case from the clients, BAA (formerly the British Airports Authority). Though no great headline-grabbing treasures were uncovered, the project has revealed much about the everyday social and economic developments of a wide area.

Obviously, because of the high cost, most excavation is highly selective. As a general rule, one can make a rough distinction between **vertical** and **horizontal excavation**. Invariably, vertical excavation is selective digging, uncovering a limited area on a site for the purpose of recovering specific information. Many vertical excavations are probes

of deep archaeological deposits, their real objective being to reveal the chronological sequence at a site.

Selective Excavation: Vertical Trenches and Testing

Selective excavation is commonplace, especially on CRM projects, when time is often of the essence. Many sites are simply too large for total excavation and can be tested only selectively, using sampling methods or carefully placed trenches. Selective excavation is used to obtain stratigraphic and chronological data, as well as samples of pottery, stone tools, and animal bones. From this evidence, the excavator can decide whether to undertake further excavation.

Figure 9.5 Aerial photograph of Old Sarum, where a Norman castle and cathedral lie inside two Iron Age earthworks. Vertical excavation would be needed to investigate these complex banks.

Source: Courtesy of robertharding/Alamy Stock Photo.

Vertical Excavation Almost invariably, vertical excavation is used to establish stratigraphic sequences. It is used especially in sites where space is limited, such as small caves and rock shelters, or to solve chronological problems, such as the sequences across sets of ditches and earthworks (see [Figure 9.5](#)). Dust Cave lies in a limestone bluff on the Middle Tennessee River in northwestern Alabama. Extensive early hunter-gatherer occupations, dating between about 8000 and 1600 B.C. , reach a depth of 5 meters (16.4 feet). Excellent preservation conditions preserved animal bones and plant materials, also such features as hearths, pits, and clay floors. Archaeologists from the University of Alabama sunk 2 by 2 meter (6.5 foot by 6.5 foot) test pits into the cave floor. When they located stone artifacts, they excavated a large 2 meter by 12 meter (6.5 foot by 39 foot) cutting down to sterile bedrock. The excavators dug the cave using the stratified layers of human occupation as their guide, each being dissected meticulously. All the occupation deposits passed through 6-millimeter (1/4 inch) mesh screen, while large samples were processed through water to obtain seeds and other minute plant remains, a technique known as flotation (see [Chapter 13](#)). They identified the different human occupation stages by using highly diagnostic stone projectile points that changed significantly over time.

We return to this important excavation in [Chapter 13](#).

Some vertical trenches reach impressive size, especially those sunk into city mounds. However, most such excavation is on a much smaller scale. Vertical trenches have been widely used to excavate early village sites in southwestern Asia (Moore, 2000). They may also be used to obtain a cross section of a site threatened by destruction, or to examine outlying structures near a village, or a cemetery that has been dug on a large scale. Vertical excavations of this kind are almost always dug in the expectation that the most vital information to come from them will be the record of layers in the walls of the trenches and the finds from them. But clearly, the information to be obtained on settlement layout from such cuttings is of limited value compared to that from a larger excavation.

Site Testing In these days of subsurface radar technology and sophisticated geomorphological studies, site testing has become more sophisticated than it was even a few years ago. However, a number of testing approaches amplify such data or are used as stand-alone ways of deciding whether a site is worth further investigation or to establish its date, function, or type of occupation. Such methods are especially important on CRM rescue projects where time is short and extensive areas have to be surveyed and test excavated.

Augurs and other forms of borers can be used to explore archaeological deposits—especially hydraulic corers, which provide column samples of subsurface layers and allow one to follow conspicuous or distinctive strata over considerable distances, even if they are buried far beneath the surface.

However, **test pits** are a frequently used form of vertical excavation. They consist of small trenches just large enough to accommodate one or two diggers, and are designed to penetrate to the lower strata of a site to establish the extent of archaeological deposits. Test pits are dug to obtain samples of artifacts from lower layers. Augurs or borers may augment this method.

The information revealed by test pits is limited. Some archaeologists will use them only outside the main area of a site, on the grounds that they will destroy critical strata. But carefully placed test pits can provide valuable insights into the stratigraphy and artifact content of a

site before larger-scale excavation begins.

Some test trenches are small control pits, dug carefully as a way of anticipating subsurface stratigraphy and occupation layers. Such excavations are reference points for planning an entire dig. More often, test pits are laid out in lines and over considerable distances to establish the extent of a site and the basic stratigraphy in different areas. Sometimes their locations are selected by statistical means, other times on the basis of surface finds or exposed features. Kent Flannery once called such trenches “telephone booths,” an apt description of small cuttings placed to acquire highly specific information. (For “shovel pits,” see [Chapter 8](#).)

Geometric Method Here, the excavator lays out a rectangular trench, then levels the surface within before taking the deposits down in thin spits, or arbitrary layers, up to 4 inches (10 cm) thick. As the excavation proceeds, the exposed walls display the stratigraphic profile. The horizontal surface consists of the same layers truncated and seen from the top. By recording both sets of layers, the researcher obtains a three-dimensional picture of the entire deposit from top to bottom. This is an efficient way of excavating and recording a site, but it has the disadvantage that one never looks at the layers for what they actually are—the record can be called somewhat inhuman in terms of recording ancient human behavior ([Figure 9.6](#)). One of us (Brian) used this method extensively to excavate mounded farming villages, where the stratigraphic layers are very hard to see and where he was working with unskilled workers. The other (Nadia) also used this technique when digging a stone-built Iron Age settlement site, set on a dry and windblown Arabian desert plane, since it, too, lacked clear stratigraphic layers.

Figure 9.6 Geometric excavation at the Shu Dynasty settlement at Jinsha, China, circa 1500 B.C.

Source: Courtesy of David Davis Photoproductions/Alamy Stock Photo.

A set of pits laid out like a chessboard is especially effective when excavating earthworks, for the walls of the pit separated by unexcavated blocks provide a continuous stratigraphic sequence across

the fortification.

Horizontal (Area) Excavation

Horizontal, or area, excavation is carried out on a much larger scale than vertical investigations and is the closest thing to total excavation at most sites. This approach uncovers contemporaneous settlement, often over large areas. However, it should be stressed that all digging strategies are based on decisions made as an excavation and a research design unfold. An excavator may legitimately switch back and forth from test pits to horizontal or vertical excavation during even a short dig.

A horizontal approach implies uncovering wide areas to recover building plans or the layout of entire settlements, even historic gardens (see [Figure 9.8](#)). The only sites that are almost invariably totally excavated are very small hunting camps, isolated huts, and burial mounds.

A good example of horizontal excavation comes from Saint Augustine, Florida (Deagan, 1983; Milanich and Milbrath, 1989) ([Figure 9.7](#)). Saint Augustine was founded on the east coast of Florida by the Spanish conquistador Pedro Menéndez de Avilés in 1565. Sixteenth-century Saint Augustine was plagued with floods, fires, and hurricanes, and was plundered by Sir Francis Drake in 1586. He destroyed the town, which was a military presidio and mission designed to protect Spanish treasure fleets passing through the Florida Straits. In 1702, the British attacked Saint Augustine. The inhabitants took refuge in the Castillo de San Marcos (which still stands). The siege lasted six weeks before the attackers retreated, after burning down the wooden buildings of the town. The colonists replaced them with masonry buildings as the town expanded in the first half of the eighteenth century.

Kathleen Deagan and a team of archaeologists investigated eighteenth-century and earlier Saint Augustine on a systematic basis, combining historic preservation with archaeological excavation. Excavating the eighteenth-century town is a difficult process on many accounts, partly because the entire archaeological deposit for three centuries is only about 3 feet (0.9 m) deep at the most, and it has been much disturbed. The excavators have cleared and recorded dozens of

barrel-lined wells. They have also used horizontal excavations to uncover the foundations of eighteenth-century houses built of tabby, a cement-like substance of oyster shells, lime, and sand. The foundations of oyster shell or tabby were laid in footing trenches in the shape of the intended house. Then the walls were added. The tabby floor soon wore out, so another layer of earth was added and a new floor was poured on top. Because the deposits outside the house had been disturbed, the artifacts from the foundations and floors were of great importance, and selective, horizontal excavation was the best way to uncover them.

Figure 9.7 Horizontal excavation at Saint Augustine, Florida.

Source: Courtesy of James Quine/Alamy Stock Photo.

Figure 9.8 A horizontal-grid excavation showing the layout of squares relative to an excavated structure at Colonial Williamsburg, Virginia.

The problems with horizontal digs are exactly the same as those with any excavation: stratigraphic control and accurate measurement. Area excavations imply exposure of large, open areas of ground to a depth of several feet. A complex network of walls or postholes may lie within the area to be investigated. Each feature is related to other structures, a relationship that must be carefully recorded so that the site can be interpreted correctly, especially if several periods of occupation are involved. If the entire area is uncovered, it is obviously difficult to measure the position of the structures in the middle of the trench, far from the walls at the excavation's edge. Better control of measurement and recording can be achieved by using a system that gives a network of vertical stratigraphic sections across the area to be excavated. This work is sometimes done by laying out a grid of square or rectangular excavation units, with walls several yards thick between one square and the next. Such areas may average 12 feet (3.6 m) square or larger. As **Figure 9.8** shows, this system allows stratigraphic control of large areas.

Large-scale excavation with grids is extremely expensive and time consuming; it is also difficult to use where the ground is irregular. However, grid excavation has been employed with great success at many sites, being used to uncover structures, town plans, and fortifications. Many area digs are "open excavations," in which large

tracts of a site are exposed layer by layer. Electronic surveying methods have solved many recording problems on large horizontal excavations, but the need for tight stratigraphic control remains.

Stripping off overlying areas of no archaeological significance to expose buried subsurface features is another type of large-scale excavation. Stripping is especially useful when a site is buried only a short distance below the surface and the structures are preserved in the form of postholes and other discolorations in the soil. Almost invariably, excavators use earthmoving machinery to clear large areas of topsoil, especially on CRM projects, a task that requires both skilled operators and a clear knowledge of the stratigraphy and soil texture (Figure 9.9).

Figure 9.9 Using a small bulldozer to strip sterile overburden at the Lohmann site, Illinois. The mechanical stripping is followed by manual scraping.

Source: Courtesy of Gari Wyn Williams/Alamy Stock Photo.

Horizontal excavation depends, of course, on precise stratigraphic control. It is normally combined with vertical trenches, which provide the information necessary for careful and accurate peeling off of successive horizontal layers.

Tools of the Trade

Indiana Jones went into the field with laborers armed with shovels, and, of course, he had his favorite bullwhip. Today's archaeologist uses more refined tools of the trade.

Earthmoving equipment is an essential part of CRM excavations and large digs. Such equipment is now widely used, especially when sites are threatened with destruction and time is short. Everything depends, however, on the archaeologist's close supervision of the operation. An expert operator can work wonders with a backhoe or front-end loader, removing even a few centimeters of soil with a delicate touch.

However, the traditional archaeological symbol is the pocket-sized handheld diamond-shaped trowel. It is the principal working tool of the archaeologist and has innumerable uses: It can ease soil from a delicate specimen; the edges can scrape a feature in sandy soil into higher relief,

be used to straighten the sides of sections, or as an instrument of stratigraphic recording, it can trace a scarcely visible stratum line or barely discernible feature. It is also used for clearing postholes and other minor work, so much so that it is rarely out of a digger's hand on small sites.

The shovel, meanwhile, with its scoop-like shape is the main tool when much ground is to be covered. It is used for piling up earth in the trench and then shoveling it into the wheelbarrow before carting the earth to the spoil heap. Systematic shoveling by teams of excavators is an excellent way of removing layers of plow soil to expose the archaeological deposits below. This works especially well when working in sandy deposits, or if the horizon beneath the plow soil contains traces of postholes, as was the case with the recent reinvestigations of the Anglo-Saxon ship burial cemetery at Sutton Hoo in eastern England (Carver, 2005).

Tools for loosening soil are the mattock and the pick. The mattock and the pick may be considered together because they are variants on the same type of tool; when used with care, they are delicate gauges of soil texture, for softer earth may come from pit fillings and other structures. The traditional Mediterranean excavation used teams of pickmen, shovelers, and basket carriers to remove the soil and dump it off the site.

Brushes are very useful, especially for dry sites. The most commonly used is the dustpan brush, which has fairly coarse bristles; it can be held by the handle or by the bristles. Wielded with short strokes, it effectively cleans objects found in dry, hard soil. The excavator uses various paintbrushes for more delicate jobs. The one-inch or half-inch domestic paintbrush has wide application in cleaning animal bones and coarser specimens. Fine camel-hair artists' brushes are best for most delicate bones, beads, and fragile ironwork (see the Doing Archaeology box).

Small tools, some improvised on the site, aid in clearing delicate finds. Six-inch nails may be filed to a point and used for delicate cleaning jobs on bones and other fragile artifacts. The needle is another tool used to clear soil from such delicate parts of skeletons as the eye sockets and cheekbones. One of the most useful digging tools is the dental pick, available in a variety of shapes.

Screens are essential tools because many finds, such as coins, glass beads, shells, small tacks, nails, and other artifacts, are minuscule. Most deposits from sites where small artifacts are likely to occur are laboriously sifted through fine screens with openings of one-quarter to one-eighth inch or smaller. Flotation techniques are also widely used (see [Chapter 13](#)).

Traditional site surveying tools include lines or metal tapes, plumb bobs, string, spirit levels, drawing boards, drawing instruments, a plane table, and a surveyor's level and compass. However, in order to take accurate measurements of the site, total stations are now routinely used.

The **total station** is the most widely used modern surveying instrument. It consists of many components, notably an electronic distance measuring (EDM) device and a theodolite. The EDM sends out a light wavelength that allows accurate and rapid measurements of the site. The total station can measure horizontal and vertical angles and their distances plus slope. They have built-in calculators that perform trigonometric calculations. Total stations can also interface with a computer for data transfer.

Doing Archaeology A Personal Excavation Tool Kit

We always like to take our own small tools on an excavation or survey, so that we always have familiar equipment on hand. Here are the contents of my tool kit, which live in a small backpack:

- *A diamond-shaped pointing trowel*, the trademark of the true archaeologist. We find the best trowel is the WHS brand. Refuse all other substitutes. The pointing trowel is a highly versatile tool for uncovering small items or clearing soil near small features, such as hearths. It is also a superb scraping tool in expert hands, ideal for tracing the dark outlines of postholes or complex stratigraphic layers in a trench wall. It is a very personal piece of equipment, and when not in use, most people carry them in their back pockets (point up, and facing away from you, for obvious reasons).
- *A small whisk broom* for cleaning up.
- *Three or four paintbrushes* of 2 inches (50 mm) width or less are

essential for fine cleaning.

- *An 8-meter steel measuring tape (or equivalent in feet and inches).* We carry our own because the excavation tapes are always in use. Most digs are now metric, so you should come equipped accordingly.
- *An ice pick or small set of dental picks* for delicate excavation work, such as cleaning bones in the soil. Some excavators prefer handmade bamboo picks, said to be more delicate on bone.
- *Pencils, erasers, and permanent ink pens* for taking notes and marking artifacts.
- *A personal notebook.*
- *Ziplock plastic bags of various sizes.* Never be without them!
- Don't forget a broad-brimmed hat, sunscreen, sunglasses, a water bottle, and good, sturdy boots, as well as gloves and knee pads if you feel a need for them. If hard hats are required, the excavation will provide them. Having some Band-Aids on hand is advisable.
- A light laptop computer or tablet is essential, especially for supervisors, while a smartphone is extremely useful for taking photographs, keeping records, or undertaking speedy research.

A wise researcher uploads the results of the day's excavation onto a computer at the end of the day, while some directors of larger sites link all site supervisors and specialists to a site computer network to encourage dialogue among them.

Storage containers are vital on any excavation to pack and transport the finds to the laboratory, as well as to store them permanently. Paper and plastic bags are essential for pottery, animal bones, and other small finds; vegetal remains and other special items may require much more delicate packaging. Cardboard cartons, supermarket bags, and even large oil drums can be used for storing finds.

The Process of Archaeological Excavation

Deciding What to Dig

Faced with the unexcavated site, many archaeological excavation begin

with making a precise surface survey and an accurate topographic map of the site. A grid is then laid over the site. The surface survey and the collections of artifacts made as part of it help determine the working hypotheses that the archaeologist uses as a basis for deciding which areas should then be excavated.

The first decision to be made is whether to carry out a total or a selective excavation, which depends on the size of the site, its possible imminent destruction, the hypotheses to be tested, and the time and money available. Most excavations are selective. Anyone contemplating a selective dig is faced with choosing the areas of the site to be dug. The choice can be clear-cut and nonprobabilistic, or it can be based on complex sampling approaches. A selective excavation to determine the age of one of the stone uprights at Stonehenge (see [Figure 2.2](#) on page 29) obviously will be at the foot of the stones. But excavation of a shell midden with no surface features may be determined by sampling and selection of random grid squares that are excavated to obtain artifact samples.

In many cases, an excavation can involve both probabilistic and nonprobabilistic choices. For the Maya city at Tikal in Guatemala (see [Figure 15.3](#) on page 291), the archaeologists were eager to learn something about the hundreds of mounds that lay in the hinterland around the main ceremonial precincts (Coe and van Stone, 2016). These mounds extended at least 6 miles (10 km) from the center of the site and were identified along four strips of carefully surveyed ground extending out from Tikal. Because excavation of every mound and structure identified on the surface was impossible, a test-pit program was designed to collect random samples of datable pottery so that the chronological span of the occupation could be established. By using a well-designed sampling strategy, the investigators were able to select about 100 mound structures for testing and obtain the data they sought.

The choice of what areas to dig can also be determined by logistical considerations: by access to the trench, time and funds available, or imminent destruction of part of a site that is close to industrial activity or road construction. Ideally, though, the archaeologist will dig where the results will be maximal and the chances of acquiring data to test working hypotheses are best.

Focus on Stratigraphy and Stratigraphic Profiles

Chapter 7 touched briefly on archaeological stratigraphy, pointing out that the basis of all excavation is the properly recorded and interpreted stratigraphic profile (Wheeler, 1954). A section through a site gives a picture of the accumulated soils and occupation levels that constitute the ancient and modern history of the locality. Obviously, anyone recording stratigraphy needs to know as much about the history of the natural processes that the site has undergone since abandonment as about the formation of the ancient site itself (Stein, 1992). The soils that cover archaeological finds have undergone transformations that have radically affected the ways in which artifacts were preserved or moved around in the soil. Burrowing animals, later human activity, erosion, wind action, grazing cattle—all can modify superimposed layers in drastic ways (Schiffer, 1987).

Archaeological stratigraphy is usually much more complicated than geological layering, for the phenomena observed are much more localized and the effects of human behavior tend to be intensive and often involve constant reuse of the same location. Subsequent activity can radically alter the context of artifacts, structures, and other finds. A village site can be leveled and then reoccupied by a new community that digs the foundations of its structures into the lower levels and sometimes even reuses the building materials of earlier generations. Postholes and storage pits, as well as burials, are sunk deep into older strata; their presence can be detected only by changes in soil color or the artifact content.

Here are some factors to be taken into account when interpreting stratigraphy (Harris 1993; see also Harris's website: www.harrismatrix.com):

- Human activities at the times in the past when the site was occupied and their effects, if any, on earlier occupations.
- Human activities, such as plowing and industrial activity, subsequent to final abandonment of the site.
- Natural processes of deposition and erosion at the time of prehistoric occupation. Cave sites were often abandoned when the walls were shattered by frost and fragments of the rock face were showering down on the interior (Courty et al., 1993).

- Natural phenomena that have modified the stratigraphy after abandonment of the site (e.g., floods, tree uprooting, animal burrowing).

Interpreting archaeological stratigraphy involves reconstructing the depositional history of the site and then analyzing the significance of the natural and occupation levels observed. This analysis distinguishes between types of human activity; between deposits that result from rubbish accumulation, architectural remains, and storage pits; between activity areas and other artifact patterns; and between human-caused and natural effects.

Philip Barker, an English archaeologist and expert excavator, advocated a combined horizontal and vertical excavation for recording archaeological stratigraphy (Figure 9.10). He pointed out that a vertical profile gives a view of stratigraphy in the vertical plane only (1995). Many important features appear in the section as a fine line and are decipherable only in the horizontal plane. The principal purpose of a stratigraphic profile is to record the information for posterity so that later observers have an accurate impression of how it was formed. Because stratigraphy demonstrates relationships—among sites, structures, artifacts, and natural layers—Barker preferred cumulative recording of stratigraphy, which enables the archaeologist to record layers in section and in plan at the same time. Such recording requires extremely skillful excavation. Various modifications of this technique are used in Europe and North America.

All archaeological stratigraphy is three-dimensional—that is, it involves observations in both the vertical and horizontal planes (see Figure 9.10). The ultimate objective of archaeological excavation is to record the three-dimensional relationships throughout a site, for these are the relationships that provide the provenance.

Archaeological Recording

Archaeological records come in three broad categories: written records, photographs and digital images, and measured drawings. Notebooks and computer files are an important part of record keeping. On site, grids, units, forms, and labels are the backbone of all recording efforts. Site grids are normally laid out with painted pegs and strings stretched

over the trenches when recording is necessary. Small-scale recording of complex features may involve using an even smaller grid that covers but one square of the entire site grid.

Written Records As the excavation unfolds, the archaeologist maintains many notebooks throughout the excavation, including the site diary or daybook, usually uploaded onto a laptop at the end of the day. The site diary is where he or she records all events at the site: the amount of work done, the daily schedule, the number of people on the digging team, and any labor problems. Dimensions of all sites and trenches and all observed data are recorded. The site diary purports to be a complete record of the procedures and proceedings of the excavation. It is more than just an aid to the fallible memory of the excavator; it is a permanent record of the dig for future generations of scientists who may return to the site to amplify the original findings. For this reason, site records need to be recorded digitally and on archivally stable paper. A distinction is made between observation and interpretation. Any interpretations or ideas, even those considered and then discarded, are meticulously recorded in the site diary or in a computer file. Important finds and significant stratigraphic details are noted carefully, as is much apparently insignificant information that may later prove to be vital in the laboratory.

Figure 9.10 Three-dimensional stratigraphic profile from the Devil's Mouth site, Amistad Reservoir, Texas. The complex deposits are correlated from one pit to the next.

Source: Le Roy Johnson, Jr., *Devil's Mouth Site*, 1964. Department of Anthropology, University of Texas, Austin.

Site Plans Site plans may vary from a simple contour plan for a burial mound or occupation midden to a complex plan of an entire town or of a complicated series of structures (Barker, 1995). Accurate plans are important, for they provide a record not only of the site's features but also of the measurement recording grid set up before excavation to provide a framework for the trenching. The advent of CAD programs—a tool that manipulates the data that have been collected and turns them into visual form—has made the production of accurate plans much

easier in expert hands, supported by a wide range of mechanisms for capturing spatial data, such as digital photogrammetry, noncontact digitizing using lasers or white light, and global positioning and similar systems. Once recorded and integrated, these spatial data can be augmented to provide novel ways to imagine and analyze possible structures and landscapes.

Such software has been one of the tools used to visualize the important farming settlement at Çatalhöyük in Central Turkey (Figure 9.11) (www.soton.ac.uk/archaeology/research/projects/catalhoyuk/). By focusing efforts on producing visualizations that are as accurate as possible in terms of the available information and the algorithms employed, the Çatalhöyük models can therefore act as archaeological places within which to think. Such computer graphic simulations are also able to integrate the many different forms of information available; act as a place to focus debate; can be used as the basis for analyses of factors such as the lighting or structural stability of hypothesized structures; and finally as a means to communicate data, methods, and ideas to a broader public. This range of applications is exemplified by the Portus Project, the Roman harbor complex near Rome, where digital technologies have been a fundamental part of the archaeological process (www.portusproject.org).

Stratigraphic records can be drawn in a vertical plane or they can be drawn axonometrically using axes. Any form of stratigraphic record is complex and requires not only skill in drawing but also considerable interpretative ability. The difficulty of recording will vary with the site's complexity and with its stratigraphic conditions. On many sites, the different occupation levels, or geological events, are clearly delineated in the stratigraphic sections. On other sites, the layers may be much more complex and less visible, especially in dry climates where the soil's aridity has leached out colors. Some archaeologists have used scaled photographs or surveying instruments to record sections, the latter being essential with large sections, such as those through city ramparts.

Figure 9.11 Effigies of bulls and a ram, male fertility symbols, from the walls of Çatalhöyük, 6000 B.C. They decorate a reconstructed shrine in a museum in Ankara.

Source: Courtesy of DEA/G. DAGLI ORTI/De Agostini/Getty Images.

Three-Dimensional Recording Three-dimensional recording is the recording of artifacts and structures in time and space. The provenance of archaeological finds is recorded with reference to the site grid. Three-dimensional recording is carried out preferably with an electronic recording device, the aforementioned total station, or, if no total station is available, with tapes, plumb bobs, and surveyor's levels (Figure 9.12). New technology—usually involving off-site computer manipulation of the data—is adding further accuracy to three-dimensional recording.

At Boomplaas Cave in South Africa, Hilary Deacon (1979) used a precise grid laid out using the cave roof to record the position of minute artifacts, features, and environmental data (see Figure 9.13). Similar grids have been erected over underwater wrecks in the Mediterranean (Bass, 2005), although laser recording is gradually replacing this technique. The various squares in the grid and the levels of the site are designated by grid numbers, which provide the means for identifying the location of finds, as well as a basis for recording them. The labels attached to each bag or marked on the find bear the grid square numbers, which are then recorded in the site notebook.

Analysis, Interpretation, and Publication

The process of archaeological excavation ends with filling in the trenches and transporting the finds and site records to the laboratory. The archaeologist retires from the field with a complete record of the excavations and with the data needed to test the hypotheses that were formulated before going into the field. But with this step, the job is far from finished; in fact, the work has hardly begun. The next stage in the research process is analyzing the finds, a topic covered in Chapters 10 through 17. Once the analysis has been completed, interpretation of the site can begin (see Chapter 3).

In these days of high printing costs, it is impossible to physically publish in complete detail the finds from any but the smallest sites. Fortunately, digital publishing is now a good solution, with the added benefit of such texts being easily accessible to anyone with an internet connection. In the long term, there may be some interesting issues about just how permanent cyberarchives actually are.

Figure 9.12 Three-dimensional recording the traditional way: (top) using a measuring square; (bottom) a close view of the square from above. A horizontal measurement is taken along the edge, perpendicular to the grid post line; the vertical measurement, from that arm with a plumb bob. Electronic instruments are now commonly used for three-dimensional recording.

Beyond publication, the archaeologist has two final obligations. The first is to place the finds and site records in a convenient repository where they will be safe and readily accessible to later generations. The second is to make the results available to a general audience as well as fellow professionals (see the Doing Archaeology box).

Special Excavation Issues

Not all excavation consists of sifting through shell mounds or uncovering huge palaces. A great deal of archaeological fieldwork is dull and monotonous, but occasionally archaeologists face unexpected and exciting challenges that require special excavation techniques. Imagine being confronted with a royal grave such as that of Tutankhamun, which took Howard Carter nearly ten years to excavate or with the incredible complexities of the burials of the lords of Sipán (see [Figure 1.9](#) on page 18). In both sites, the excavators had to find special techniques for dealing with these fragile discoveries. Let us examine some of the most common problems in excavation.

S i T E > Tunneling at Copán, Honduras <

Tunneling is rarely used in archaeological excavation, except in structures such as Maya pyramids, where the history of the structure can be deciphered only by tunneling into the otherwise inaccessible interior. Slow going and expensive, tunneling is extremely difficult and presents complex problems in interpreting stratigraphic layers, which are on either side of the trench and on each wall.

The most extensive tunneling project of recent times is that used to study the sequence of Maya temples that make up the great Acropolis at Copán, Honduras (Fash, 2001). Here, the excavators tunneled into an eroded slope of the pyramid worn away by the nearby Rio Copán. They were aided in their task by deciphered Maya glyphs, which date this

political and religious precinct to between A.D. 420 and 820. The archaeologists followed ancient plaza surfaces and other features buried under feet of compacted earth and rock fill. They used computer-based surveying stations to create three-dimensional representations of changing building plans.

Maya rulers had a passion for commemorating their architectural achievements and the rituals that accompanied them with elaborate glyphs. The tunnelers had a valuable reference point in an inscription on a ceremonial altar called Altar Q, which provides a textual guide to the ruling dynasty at Copán, sponsored by the sixteenth ruler, Yax Pac. The glyphs on Altar Q record the arrival of the founder Kinich Yax K'uk Mo' in A.D. 426 and portray the subsequent rulers who embellished and expanded the great city.

Fortunately for the archaeologists, the Acropolis is a compact royal precinct, which made it relatively easy to decipher the sequence of buildings and rulers. In the end, the tunneling project linked individual structures with the recorded history of Copán's 16 rulers. The earliest building belonged to the reign of Copán's second ruler, but the buildings fall into three separate political, ritual, and residential complexes. By A.D. 540, these complexes were linked into a single Acropolis. Just unraveling the complex histories of all the demolished buildings has taken years of tunneling and stratigraphic analysis. Today, we know that the core of the Acropolis evolved from a small masonry structure decorated with brightly painted murals, perhaps the residence of the founder Kinich Yax K'uk Mo' himself. His successors elaborated the ceremonial complex beyond recognition.

Copán's Acropolis is an extraordinary chronicle of Maya royal power and dynastic politics, rooted firmly in a complex spiritual world revealed by deciphered glyphs. It is also a triumph of careful excavation and stratigraphic interpretation under demanding conditions.

[Figure 9.13 Artist Tatiana Proskouriakoff's reconstruction of the central precincts at Copán, Honduras.](#)

Source: Courtesy of Peabody Museum of Archaeology and Ethnology, Harvard University, 58-34-20/57472.

Fragile Objects

Narratives of nineteenth-century excavation abound with accounts of spectacular and delicate discoveries that crumbled to dust on exposure to the air. Regrettably, this still happens with some discoveries today, but many extraordinary recoveries of fragile artifacts have also been made. In almost every find, the archaeologist responsible has had to use great ingenuity, often with limited preservation materials on hand.

Leonard Woolley faced very difficult recovery problems when he excavated the Royal Cemetery at Ur-of-the-Chaldees in the 1920s (Woolley, 1954). In one place, he recovered an exquisite offering stand of wood, gold, and silver portraying a he-goat with his front legs on the branches of a thicket, by pouring paraffin wax over the scattered remains. Later, he rebuilt the stand in the laboratory to a close approximation of the original.

Conservation of archaeological finds has become a highly specialized field that covers every form of find, from textiles and leather to human skin and basketry (Cronyn, 1990). Many conservation efforts, such as those used to preserve the Danish bog corpses, can take years to complete (see [Figure 4.4](#) on page 68) (Glob, 2004). One of the largest conservation efforts was mounted at Ozette, Washington, where the sheer volume of waterlogged wooden artifacts threatened to overwhelm the excavators (see [Figure 4.5](#) on page 69). The finds that needed treatment ranged from tiny fishhooks to entire planks. A large conservation laboratory was set up in Neah Bay, where the finds were processed after transportation from the site. Many objects were left to soak in polyethylene glycol to replace the water that had penetrated the wood cells, a treatment that takes years for large objects. The results of this major conservation effort can be seen in the Neah Bay Museum, where many of the artifacts are preserved (Kirk, 1974).

Burials

Human remains can be encountered either as isolated finds or in the midst of a settlement site. Some projects are devoted to excavating an entire cemetery. In all cases in which graves are excavated, the burial and its associated grave, funerary furniture, and ornamentation are considered as a single excavation unit or grave lot.

Human skeletons are a valuable source of information on prehistoric

populations. The bones can be used to identify the sex and age of a buried individual, as well as to study ancient diseases, and in some cases, diets. A whole series of new techniques, including DNA analysis, are revolutionizing studies of prehistoric humans (Buikstra and Beck, 2006).

Excavation of burials is a difficult and routine task that must be performed with care because of the delicacy and often bad state of the bones. The record of the bones' position and the placement of the grave goods and body ornaments is as important as the association of the burial, for the archaeological objective is reconstructing burial customs as much as establishing chronology (Simon, 1997; White, 1999). Although the Maya lords of Mesoamerica were sometimes buried under great pyramids—as at Palenque, where the Lord Pacal lay under the Temple of the Inscriptions (Coe, 2011)—most burials are normally located by means of a simple surface feature, such as a gravestone or a pile of stones, or through an accidental discovery during excavation. Once the grave outline has been found, the skeleton is carefully exposed from above. The first part of the skeleton to be identified will probably be the skull or one of the limb bones. The main outline of the burial is then traced before the delicate backbone, feet, and finger bones are uncovered. The greatest care is taken not to displace the bones or any of the ornaments or grave goods that surround them. Normally, the undersurfaces of the bones are left in the soil so that the skeleton may be recorded photographically before removal (see [Figure 9.14](#)). Either the burial is removed bone by bone or it is removed as a single unit to the laboratory, where it is cleaned at leisure. Removal of the entire unit is expensive and is done only when a skeleton is of outstanding scientific importance.

Some burials are deposited in funerary chambers so elaborate that the contents of the tomb may reveal information not only about the funeral rites but also, as in the Sumerian royal burials at Ur, about the social order of the royal court (see [Chapter 16](#)). The great royal tombs of the Shang civilization of northern China are an example of complex tombs, where careful excavation made possible the recording of many chariot features that otherwise would have been lost (Barnes, 2003). The shaft, axle, and lower parts of the chariot wheels were visible only as discolored areas in the ground.

Doing Archaeology Site Records

We keep all kinds of notebooks and records on an excavation, including the following, which are all important: Of utmost importance on most professional modern excavations, including Çatalhöyük and all CRM-equivalent digs in the United Kingdom, are pro forma **context recording sheets**, which each excavator is expected to meticulously fill out as the dig progresses. With each new piece of work, the archaeologist is required to start a new sheet, which contains boxes related to deposit, cut, finds, and so on, with space for interpretation (and supervisors' views or checks as appropriate). These formal sheets force excavators to observe and record all potentially relevant data, rather than leaving observations up to individual whim. Post-evacuation analysis depends on the accuracy of these standardized field notes.

Those of us on research-led digs may not be expected to complete such formal sheets; instead, we keep a day-to-day journal of the excavation, which begins the day we reach camp and ends when we leave at the end of the dig. This is a general diary in which we write about the progress of the excavation, record thoughts and impressions, and write spontaneously about the work we are engaged in. This is also a personal account in which we write about conversations, discussions, and other people-related matters, such as theoretical disagreements between members of the research team. This journal is absolutely invaluable when you are in the laboratory or writing up the excavation for publication, for it contains many forgotten details, first impressions, and passing thoughts that would otherwise not have been set down. We use a journal for all our research, even when visiting sites. For example, one of us (Brian Fagan) had a journal that reminded him about details of his visit to the excavations at the Maya center at Xunantunich in Belize that had escaped his memory.

At Çatalhöyük, archaeologist Ian Hodder (1999) asks his colleagues not only to keep daily diaries but he also connects them to the site computer network, so that everyone knows what others are thinking, and also as a basis for continual discussion about individual trenches, finds, and excavation problems. From our own experience, we suspect that this is a wonderful way to ensure that theoretical dialogue keeps

pace with practical recording and actual excavation.

The *site notebook* is the formal record of the excavations, which contains technical details of the dig, information on excavation and sampling methods, stratigraphic data, records of unusual finds, and major features, among other things. This is really a logbook of the day-to-day operation of the dig. The site notebook is also the entry point into all site records and is cross-referenced accordingly. We usually use loose-leaf notebooks, so that we can insert single-page forms for recording features and other important discoveries at the correct place in the book. Your site notebook should ideally be compiled on archival paper, as it is the permanent record of the excavation.

The *logistical notebook* is self-evident, the place where we record mundane details of accounts, key addresses, and other data relating to the administration and domestic life of the excavation.

On-site, archaeologists typically use pencils and pens to record their work. They tend to draw sections and features directly onto semi-see-through perma-trace, which is placed over gridded paper that provides a scale, make handwritten field notes, and also routinely use total stations (see previously). Laptops and the Web are normally used off-site. Of course, using computers has the advantage of instant duplication of vital information and gives you the ability to meld your notes with survey data and other materials while still on-site. More recently, some research digs have also begun to harness the now-ubiquitous smartphone as a means to quickly capture images and share data (Westcott Wilkins, 2015).

The excavation of American Indian burials has generated furious political controversy in recent years, with native groups arguing that it is both illegal and unethical to dig up even the prehistoric dead. Reburial and repatriation legislation now restricts the excavation of ancient burials, and many collections are now being returned to their historic owners for reburial (Wilcox, 2010; see also [Chapter 18](#)). In some states, such as California, it is now illegal to disturb ancient Native American burial grounds.

Structures and Pits

Open excavations are normally used to uncover structures of

considerable size (Barker, 1995). Grids allow stratigraphic control over the building site, especially over the study of successive occupation stages. Many such structures may have been built of perishable materials, such as wood or matting. Wooden houses are normally recognized by the postholes of the wall timbers, and sometimes, foundation trenches. Clay walls collapse into a pile when a hut is burned or falls down; thus the wall clay may bear impressions of matting, sticks, or thatch. Stone and mudbrick structures are often better preserved, especially if mortar was used, although sometimes later builders remove the stone, and only foundation trenches remain. Stratigraphic cross sections across walls give an insight into the structure's history. The dating of most stone structures is complicated, especially when successive rebuilding or occupation of the building is involved. Some of the most spectacular buildings in the archaeological record leave few traces on the surface (Figure 9.14). For example, at the Iron Age site of Veien in Norway, Lil Gustafson and her team identified a series of four longhouses as revealed by their shadow postholes. Each of the longhouses was destroyed before the next was built, possibly in some sort of a power struggle. "House 1" was replaced by "House 2" at around A.D. 1. At 154 feet (47 m) in length, the latter is double the usual size of a typical Norwegian longhouse, suggesting Veien was once a very important site (Gustafson, 2011).

People of the Past Finding Akhenaten's People

In A.D. 1349, the "heretic" Egyptian pharaoh, Akhenaten, came to throne, sparking one of the most controversial periods in Egyptian history. Husband of the beautiful Nefertiti, and possible father of Tutankhamun, he promoted the sun god Aten, above all others, which flew in the face of religious tradition. Such was Akhenaten's devotion to Aten that he created an entire city to its cult. The city—now known as El Amarna—lies halfway between the great cities of Memphis and Thebes (modern Cairo and Luxor respectively) and was home to between 30,000 and 50,000 people. All of its inhabitants—officials, servants, and craftsmen—followed the royal court to Amarna where they set about reestablishing their lives and livelihoods.

However, following Akhenaten's death, after 17 years on the throne, his city was abandoned as the priesthood sought to reinstate the

religious status quo to Egypt. With the desertion of Amarna, the priests inadvertently created a remarkable archaeological time capsule: a substantially complete Bronze Age city that can be very precisely dated and is not buried below layers of later occupation but under a thin cover of sand and rubble.

Realizing its potential, the city has attracted a steady flow of excavators since the late nineteenth century, and since 1997 Professor Barry Kemp of the University of Cambridge, England, has directed the current mission. His excavations have uncovered over 1,000 buildings including houses, palaces, temples and workshops, with Kemp's work providing unique and important insights into how an ancient Egyptian city might have looked and functioned. One burning question remained, however. Although the elaborately decorated rock-cut tombs of Akhenaten's officials were long known, where were the graves of the thousands of common people? Thousands of people had lived at the site, yet no graveyard was known.

In 2003, the mystery was solved by team member Dr Helen Fenwick, who systematically walked over the desert beyond the city (see [Chapter 8](#) for more on field survey). She began to notice scatters of potsherds and pieces of bone suggestive of looted burials, which ultimately led her to locate not one, but two groups of cemeteries. Here, finally, were the graves of Amarna's "lost" people. To date, the team has excavated over 500 tombs, making this one of the largest collections of well-excavated skeletal remains available for study from pharaonic Egypt (Stevens et al., 2016).

View across the North Palace at Amarna, the living areas for Akhenaten and Queen Nefertiti. However, as the skeletons from the recently discovered non-elite cemeteries reveal, building Akhenaten's short-lived city of Amarna was backbreaking work.

Source: Mike Shepherd/Alamy Stock Photo.

The digging was hot, dusty and dry, and many of the graves were badly robbed, mostly in the distant part. Moreover, as the plunderers moved from grave to grave, they often threw bones or other burial goods onto the ground, leaving a complicated puzzle for the archaeologists to solve. Thankfully for us, the robbers seem to have

been mostly interested in metal items, which means they left many of the more “mundane” artifacts behind—still manna from heaven for archaeologists. As such, the team has been able to piece together a remarkably detailed picture of how the people prepared for their deaths. It seems that bodies were usually wrapped in textile then laid out in a coffin, which was typically simply a mat of sticks wrapped around the body, sometimes bound in place with rope. Occasionally box coffins made of pottery, mud, or wood were used—with wooden box coffins being most common for babies and small children, perhaps reflecting a wish to protect the vulnerable. The people were rarely buried with much—even the unlooted graves were often devoid of any goods, though sometimes small artifacts were found, such as three carved and well-worn protective amulets discovered in the grave of a woman and child.

The skeletal evidence has provided copious insights into what life was like for those who lived in Amarna. At the southern cemetery, the larger of the two, the team has modeled a cemetery population of approximately 6,000 individuals, which represents roughly a burial a day over the course of the city’s occupation. Death was clearly an everyday occurrence. Indeed, analysis of the skeletons in the southern cemetery shows many nutritional deficiencies. There is also widespread evidence of heavy labor that must have caused great suffering—including spinal trauma, fractures typical of occupational accidents, and arthritis. In the southern cemetery, the early thirties was the average age of death—for those who survived into adulthood.

Meanwhile, close analysis of 105 skeletons excavated from the other (northern) cemetery suggests that this was a burial place for adolescents: over 90 percent of the burials were youngsters between the ages of seven and 25 (seven being the approximate end of non-working childhood in Ancient Egypt), with most dying before the age of 15. As at the southern cemetery, injuries were rife. Most of the 15- to 25-year-olds had some kind of traumatic injury with around 10 percent having osteoarthritis, while 16 percent of those under age 15 had spinal fractures and a range of other issues usually associated with heavy workloads. It is hard to avoid the conclusion that the northern cemetery almost certainly represents a workforce of children and teenagers who had to perform frequent, heavy, literally backbreaking labor. As a final

nail in the proverbial coffin of these youngsters, almost every skeleton in the northern cemetery showed evidence of malaria.

A limestone statuette depicting the pharaoh, Akhenaten, with his wife, Nefertiti, c. 1350 B.C.

Source: Album/Alamy Stock Photo.

Without comparative data from other cemeteries of similar date, it is impossible to tell whether Amarna's cemeteries offer a typical snapshot of non-elite Egyptian life at the time, or whether the people were suffering especially badly since they were building a new city from scratch. Whatever the case, the new excavations show how life at Amarna was hard, with a heavy taxation in terms of workload, disease, and likely chronic dietary insufficiency (Stevens et al., 2016).

The pueblos of the American Southwest offer another type of problem in excavation. The many rooms of the pueblos contain complicated deposits full of occupation debris and many artifacts. Such assemblages can be used to identify the activities carried out in different spaces.

Storage and rubbish pits are commonly found on archaeological sites and may reach several meters in depth. Their contents furnish important information on dietary habits, data gleaned from food residues or caches of seeds. Trash pits are even more informative. Garbage pits and privies at Colonial Williamsburg have yielded a host of esoteric finds, including wax seals from documents that were used as toilet tissue (Noël Hume, 1983). Some historic pits can be dated from military buttons and other finds.

[Figure 9.14 Longhouses, like this reconstructed Norse example from the Lofoten Islands in northern Norway, require meticulous excavation to uncover postholes and other traces of the human structure.](#)

Source: Dave Stamboulis/Alamy Stock Photo.

Doing Archaeology Some Problems in Archaeological Excavation

Archaeological excavation involves a wide range of sites and different

research problems, only a few of which we can cover in these chapters. [Figure 9.15](#) illustrates how an excavator dates a structure or building by its associated artifacts. A brick wall was built in a foundation trench that was filled with brick dust and clay. Someone dropped a coin dating to 1723 into the clay as the trench was being filled. Obviously, then, the building of which the wall forms a part dates to no earlier than 1723.

The excavation of individual features, such as pits used for cooking, storage, or other purposes, requires the excavator to both delineate the edge of the pit and to stratigraphically excavate the pit fill. In excavations at Ziyaret Tepe—the Assyrian provincial capital of Tushhan in modern southeastern Turkey—a team led by Timothy Matney of the University of Akron, Ohio, uncovered a flat-bottomed pit dating to the Early Iron Age. They found that it was filled with fine ash and charred debris probably from the burning of animal dung for fuel. The layers of ash can be seen in the unexcavated section left on the west edge of the pit ([Figure 9.16a](#)). To be sure, the excavation of individual features, such as cooking pits involves careful dissection of the pit fill. Three cooking pits at the Norwegian site of Veien (mentioned earlier) were cut into the sandy subsoil. The fill was identified by its splintered stones (the result of constant reheating) and its contents (notably cooking debris). It was then sectioned and excavated ([Figure 9.16b](#)).

The same principles of meticulous vertical and horizontal excavation are applied to all sorts of sites, among them some of the earliest human kill sites and camps in the world. The complex layers of the Gran Dolina site in Spain's Sierra de Atapuerca are a challenge to excavate, centimeter by centimeter, deciphering complex natural layers and fossil bone deposits, some of which are between 800,000 and 1.3 million years old ([Figure 9.17](#)). The horizontal excavations revealed associations between the stone tools and bones. Every find, however small, was plotted in position before removal in order to ensure the recording of the precise content of every object on the site.

Shell middens can reveal important information about water's edge adaptations. A midden is a dump of remains and occupation debris, including shells, fish bones, ash, and occasional artifacts, piled up over many years. The Galatea Bay shell midden near Auckland, North Island, New Zealand, excavated by Wilfred Shawcross in the 1960s, is a classic example of how to dig such a site. Galatea Bay yielded shells,

fish bones, and artifacts used for processing mollusks, as well as evidence for seasonal occupation from fish remains. On larger shell middens, many archaeologists use sampling methods to test the dense concentration of shells and other materials.

Excavations through entire city mounds or large structures like temples and forts require complex vertical excavations, which shows a stratigraphic profile through the ramparts of the ancient city of Harappa in the Indus Valley, Pakistan, dating to about 2000 B.C.

Whatever the size and complexity of the excavation—whether a CRM excavation conducted in advance of road construction, or a multi-season investigation of a Mesopotamian city or Maya center—it is based on careful recording, so that no artifact, structure, or even the smallest of food remains is taken out of its context in time and space. The archaeologist's archives, drawings, notes, photographs, and the final report on the site represent the only permanent record. Archaeological excavation, even in its most refined approaches, is destruction of a finite resource.

Figure 9.15 Dating construction of a building by its associated artifacts and stratigraphy.

Figure 9.16 Storage and fire pits. (a) A flat-bottomed pit from Ziyaret Tepe, the ancient Assyrian capital of Tushhan, southeastern Turkey, showing the fine ash filling. From the excavations led by Professor Timothy Matney of the University of Akron, Ohio. (b) Excavating features in a mound near the Minehow subterranean tomb, Orkney Islands, Scotland.

Source: Professor Tim Matney, University of Akron, Ohio.

Figure 9.17 Excavations at Gran Dolina, in the Sierra de Atapuerca, Spain, where numerous remains of early hominins have come to light, including examples that date to before 750,000 years ago.

Source: Brian Fagan.

Pits of all kinds are normally identified by circular discolorations in the soil. The contents are then cross sectioned, and the associated finds are analyzed as an associated unit. Large pits, which may contain thousands of seeds and other informative materials, are excavated with particular care.

Postholes are normally associated with houses and other such structures. The posts they once contained were buried in holes that were dug larger than the base of the post itself. When the structure was abandoned, the post might have been left to rot, removed, burned or cut off. The traces each of these outcomes leaves in the ground differ sharply and can be identified with careful excavation. Sometimes it is possible to find fragments of the post or charcoal from its burning, which enables archaeologists to identify the type of wood used.

Each archaeological site offers challenges to the investigator, including preservation, recording, or interpretation. Though individual methods may vary from site to site, from area to area, and even along national boundaries, the fundamental objective is the same: to recover and record data from below the ground as systematically and scientifically as possible.

Summary

1. Excavation is a primary way in which archaeologists acquire subsurface data about the past. Modern archaeologists tend to carry out as little excavation as possible, because digging archaeological sites destroys a finite resource—the archaeological record.
2. Modern excavations are often conducted by multidisciplinary research teams made up of specialists from several disciplines who ideally work together on a carefully formulated research design.
3. All archaeological excavation is destruction of a finite resource. Accurate methods for planning, recording, and observation are essential. Today, excavation is the strategy of last resort, as it is potentially destructive.
4. The Koster site in Illinois, where the excavators devised a sophisticated data-flow system to keep their research design up to date, illustrates the essential details of a research design.
5. Sites can be excavated totally or, as is more common, selectively. Vertical excavation is used to test stratigraphy and to make deep probes of archaeological deposits. Test pits, often combined with

various sampling methods, are dug to give an overall impression of an unexcavated site before major digging begins. Horizontal or area excavation is used to uncover far wider areas and especially to excavate site layouts and buildings.

6. The process of archaeological excavation begins with a precise site survey and establishment of a site recording grid. A research design is formulated, and hypotheses are developed for testing. Placement of trenches is determined by locating likely areas or by sampling methods. Excavation involves not only digging but also recording of stratigraphy and the provenances of finds, as well as observations of the processes that led to the site's formation.
7. Careful stratigraphic observation in three dimensions is the basis of all good excavation and is used to demonstrate relationships among layers, and between layers and artifacts.
8. Excavation is followed by analysis and interpretation, and finally, publication of the finds to provide a permanent record of the work carried out.
9. Among the special excavation problems are the recovery of fragile objects, human skeletons, and structures and pits.

Further Reading

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PART IV

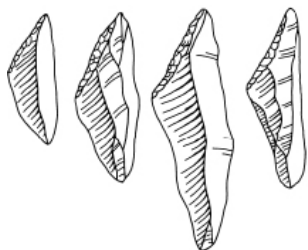
ANALYZING THE PAST

ARTIFACTS AND TECHNOLOGY

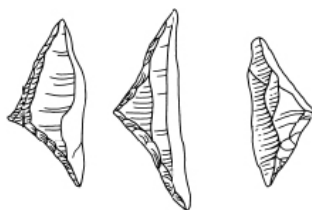
[Part IV](#) begins our exploration of archaeology's ultimate objectives: constructing culture history, reconstructing past lifeways, and studying cultural process. [Chapters 10](#) and [11](#) discuss the classification of artifacts and the ways in which ancient peoples used organic and inorganic raw materials. Proper understanding of technology, its uses, and its limitations is an essential preliminary to any discussion of ancient lifeways, our relationships to the changing environment, and culture change in the past.



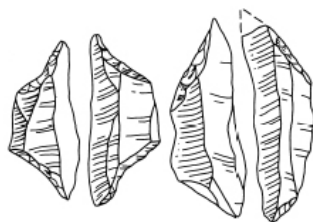




Obliquely blunted



Triangular



Elongated trapeze



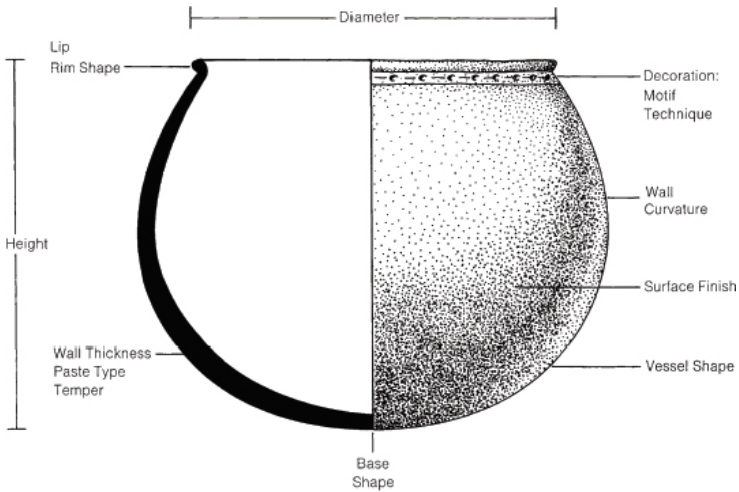
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10

Classifying Artifacts

CHAPTER OUTLINE

[Classification](#)

[Processes of Archaeological Classification](#)

[Assemblages and Patterns](#)

Unknown man, perhaps a priest or ruler, from Mohenjodaro, Pakistan, c. 1800 B.C.

Source: Courtesy of robertharding/Alamy Stock Photo.

We are obsessed with technology. Our society can land someone on the moon, aim cruise missiles at small targets hundreds of miles away and hit them, transplant human hearts, and send pilotless aircraft powered by the sun high above the earth. Technology has changed history. The harnessing of fire just after 2 million years ago enabled our remote

forebears to settle in bitterly cold climates. By 25,000 years before present, we were using small ivory needles with perforated eyes that facilitated the development of layered clothing that allowed us to survive comfortably in subzero winters. The development of the outrigger canoe enabled people living in the Southwest Pacific to colonize offshore islands hundreds of miles beyond the horizon 3,000 years ago.

Since the earliest times, our cultures and technological inventiveness have allowed us to adapt to a great range of natural environments and to develop ingenious ways of intensifying the food quest of fishing and hunting sea mammals and of farming the land in a world of growing population densities. Modern humanity's myriad technologies are ultimately descended from the first simple tools made by human beings by 3.3 million years before present.

We know more about ancient technologies than any other aspect of the societies of the past because we study the material remains of long-forgotten behavior. Thus, it is hardly surprising that the analysis of artifacts is a major part of archaeological research and the follow-up from site surveys or excavations, whatever the size of the project. This chapter describes the processes of classifying artifacts. [Chapter 11](#) discusses artifact analysis and the major technologies used in ancient times.

Artifact analysis starts in the field alongside excavation—processing and organizing the finds so that they can be analyzed and interpreted. At the same time, the excavator keeps an eye on the data flowing from the trenches and plans further excavation to obtain larger samples, if they are required.

These first stages in processing newly excavated archaeological data are entirely routine. Most excavations maintain some form of field laboratory. It is here that the major site records are kept and developed, stratigraphic profile drawings are kept up to date, and radiocarbon samples and other special finds are packed for examination by specialists. A small team staffs the field laboratory. They ensure that all finds are cleaned, processed promptly, packed carefully, and labeled and recorded precisely. A successful laboratory operation allows the director of the excavation to evaluate the available data daily, even hourly. It is here, too, that basic conservation work is carried out—

reassembling fragmented pots, hardening bones with chemicals, or stabilizing fragile objects. Computers play an important role in the field laboratory, for they are used to code vast quantities of information for later use.

The analysis continues back in the home laboratory, whether a small ceramic study for a cultural resource management (CRM) project or an enormous, years-long activity that results from a large-scale survey or excavation. You need a good eye for detail, an orderly mind, and, above all, infinite patience. It takes weeks to sort and classify even a relatively small artifact collection. We have colleagues who have spent years analyzing a single medium-sized excavation.

Successful artifact analysis revolves around classification and typology, two fundamental archaeological skills.

Classification

Our attitude toward life and our surroundings involves constant classification and sorting of massive quantities of data. We classify types of eating utensils: knives, forks, and spoons; each type has a different use and is kept in a separate compartment in the drawer. We group roads according to their surface, finish, and size. A station wagon is classified separately from a truck. In addition to classifying artifacts, lifestyles, and cultures, we make choices among them. If we are eating soup, we choose to use a spoon.

All people classify because doing so is necessary for abstract thought and language. But everyday classes are not often best for archaeological purposes. In our daily life we habitually use classification as a tool for our lifestyle. However, just like using a computer, classification should be a servant rather than a master. Sometimes our classifications of good and bad—those based on color of skin or on our definitions of what is moral or immoral—are made and then adhered to as binding principles of life without ever being questioned or modified, no matter how much our circumstances may change. The dogmatism and rigidity that result from these attitudes are as dangerous in archaeology as they are in daily life. In archaeology, **classification** is a research tool, a means for ordering data (see the Doing Archaeology box).

Classifications used by archaeologists follow directly from the

problems they are studying. Let us say that our excavator is studying changes in pottery designs over a 500-year period in the Southwest. The classification he or she uses will follow not only from what other people have done but also from the problems being studied. How and even what you classify stem directly from the research questions asked of the data. Because the objectives of classifications may change according to the problems being investigated, archaeologists must be sensitive to the need for revising their classifications when circumstances require it.

Taxonomy and Systematics

Taxonomy is the name given to the system of classifying concepts, materials, objects, and phenomena used in many sciences, including archaeology. The taxonomies of biology, botany, geology, and some other disciplines can be highly sophisticated. Archaeology has built its own taxonomy of specialist terminologies and concepts quite haphazardly. Universal comparisons and classifications have been virtually impossible. British archaeologists refer to cultures; North American scholars refer to phases; and the French refer to civilizations. Each term has basically the same meaning as the others, but the subtle differences stem from cultural traditions and from different field situations (Dunnell, 1986).

Systematics is essentially a way of creating units of classification that can be used to categorize things as a basis for explaining archaeological or other phenomena (Dunnell, 1971). It is a means of creating units of classification within a scientific discipline. Biologists classify modern human beings within a hierarchical classification developed by Carl Linnaeus in the eighteenth century. It begins with the kingdom Animalia and proceeds in increasingly specific units through the phylum Chordata (animals with notochords and gill slits), the subphylum Vertebrata (animals with backbones), the class Mammalia, the subclass Eutheria, the order Primates, the suborder Hominoidea (apes and hominins), the family Hominidae, the genus *Homo*, the species *sapiens*, and finally, the subspecies *sapiens*. This hierarchy is gradually refined until only *Homo sapiens sapiens* remains in its own taxonomic niche. The biological classification just described

is based on each form's having common progenitors or just similarities. It consists of empirically defined units (kingdom, phylum, etc.) in which each element is defined and related to the others, whereas in archaeology, classification is based on the relation of the elements to the problem being studied.

DISCOVERY The Lady of Cao, Peru, 2007–

Only rarely do archaeologists discover intact tombs containing well-preserved bodies. Yet such was the case when archaeologists discovered the sealed, unlooted, elite tomb of the “Lady of Cao” at the very summit of the Huaca Cao Viejo pyramid, at El Brujo, on the coastal plain of North Peru (Barreda, 2007).

The Lady lived during the Moche Period (circa A.D. 1–700) and died around A.D. 400. Her funeral bundle was decorated with a large embroidered face. Her head rested on a pillow and she was covered by a cane mat—perhaps her bed in life. She was wrapped in hundreds of yards of carefully woven cotton cloth. On her body she wore a finely woven dress that was spotted with small amounts of human blood, possibly splashed upon her during a ceremony. Beneath the dress her naturally desiccated skin was fully intact (Figure 10.1). Her limbs were decorated with complex tattoos of spiders, seahorses, and snakes. She was young when she died—perhaps in her twenties—and the latest research suggests she died in childbirth. This remarkable Lady is the best-preserved Moche body ever found.

She was interred with a host of ceremonial items—including gold jewelry and headdresses of typical Moche type. Also in her grave were sewing needles, weaving tools, and even raw cotton. She was also buried with weapons: two ceremonial war clubs and 23 spears. Next to her lay the body of a sacrificed teenage girl—the rope still around her strangled neck. Three adults and two more teenage sacrifices accompanied them. The archaeologists hope to extract mitochondrial DNA from them to determine if they were related and do isotopic work to track the elite woman's lineage and life history.

In the meantime, the careful classification and analysis of the objects found within the tomb is shedding new light on the Moche culture—and indeed causing more questions to be asked. Why, for example, was she buried with weapons? Was she a female warrior? Or were these

symbols of power? Or were they funeral gifts from other warriors? The designs of her tattoos, plus the embroidered face, are unknown from Moche art, which also inspires questions over who she was. Was she a foreigner?

Few archaeological discoveries offer such unique portraits of the remote past. This discovery is set to enhance our very understanding of Moche civilization.

Figure 10.1 Studying the mummy of the Lady of Cao, El Brujo, Peru.

Source: Courtesy of Ira Block/National Geographic/Getty Images.

Doing Archaeology Artifact Classification

The difficulties of artifact classification are well demonstrated by the classic example of a basketry tray, shown in [Figure 10.2](#). This fine Pomo Indian basket being made in northern California is a good example of the difficulties of archaeological classification. The design was formed in the maker's mind by several factors, most important of which is the tremendous reservoir of learned cultural experience that the Pomo acquired, generation by generation, through the several thousand years they lived in northern California. The designs of their baskets are learned and relate to the feeling that such and such a form and color are "correct" and traditionally acceptable. But there are more pragmatic and complex factors, too, including the circular, bowl-like shape that enables the user to winnow wild seeds by tossing them gently. Each attribute of the basket has a good reason for its presence—whether traditional, innovative, functional, or imposed by the technology used to make it. The basket has a rich red-brown color, from the species of reed used to make it.

The problem for the archaeologist is to measure the variations in human artifacts, to establish the causes behind the directions of change, and to find what these variations can be used to measure. This fine winnowing tray is a warning that variations in human artifacts are both complex and subtle.

The Pomo hunter-gatherers occupied a large stretch of northern California coast and interior north of the San Francisco Bay area. There were about 12,000 of them living in small bands at European contact.

They enjoyed a complex ritual and social life.

Figure 10.2 Making a Pomo basketry tray.

Source: Courtesy of Inga Spence/Alamy Stock Photo.

Objectives of Classification

Although classification in archaeology depends on the problem being studied, four major objectives that are common to all archaeological studies can be identified:

1. **Organizing Data into Manageable Units.** This step is part of the preliminary data-processing operation, and it commonly involves separating finds on the basis of raw material (stone, bone, and so on) or artifacts from food remains. This preliminary ordering allows much more detailed classification later on.
2. **Describing Types.** By identifying the individual features of hundreds of artifacts, or clusters of artifacts, the archaeologist can group them, by common attributes, into relatively few types. These types represent patterns of separate associations of attributes. Such types are economical ways of describing large numbers of artifacts. Which attributes are chosen depends on the purpose of the typology.
Artifact types (sometimes called archaeological types) are based on criteria set up by archaeologists as a convenient way of studying ancient tool kits and technology. They are a useful scientific device that provides a manageable way of classifying small and large collections of prehistoric tools and the by-products of manufacturing them.
3. **Identifying Relationships Between Types.** Describing types provides a hierarchy, which orders the relationships between artifacts. These stem, in part, from the use of a variety of raw materials, manufacturing techniques, and functions.
These three objectives are much used in culture-historical research. Processual archaeologists may use classification for a fourth:
4. **Studying Assemblage Variability in the Archaeological Record.** These studies are often combined with middle-range

research on dynamic, living cultural systems (see [Chapter 14](#)).

Archaeological classifications are artificial formulations based on criteria set up by archaeologists. These classificatory systems, however, do not necessarily coincide with those developed by the people who made the original artifacts (Dunnell, 1986; Willey and Phillips, 1958).

Typology

Typology is a system of classification based on the construction of types. A **type** is a grouping of artifacts based on form, chronology, function, or style. Typology is a search for patterns among either objects or the variables that define those objects, a search that has taken on added meaning and complexity as archaeologists have begun to use computer technology and sophisticated statistical methods (Adams and Adams, 1991). This kind of typology is totally different from arbitrarily dividing up the objects and variables.

Typology enables archaeologists to construct arbitrarily defined units of analysis that apply to two or more samples of artifacts, so that these samples can be compared objectively. These samples can come from different sites or from separate levels of the same site. Typology is classification to permit comparison, an opportunity to examine underlying patterns of human design and behavior (Adams and Adams, 1991; Brown, 1982). Typology, as James Deetz put it, has one main aim: “classification which permits comparison... . Such a comparison allows the archaeologist to align his assemblage with others in time and space” (1967: 74).

[Figure 10.3](#) A Tlingit helmet and mask carved from a single piece of wood. This would be a “natural type” if found in an archaeological context. It would obviously be classified as a helmet from the perspective of our cultural experience.

Source: Courtesy of Werner Forman/Universal Images Group/Getty Images.

For accurate and meaningful comparisons to be made, rigorous definitions of analytical types are needed, to define not only the “norm” of the artifact type but also its approximate range of variation, at either end of which one type becomes one of two others. Conventional

analytical definitions are usually couched in terms of one or more attributes that indicate how the artifact was made, the shape, the decoration, or some other feature that the maker wanted the finished product to display. These definitions are set up following carefully defined technological differences, often bolstered by measurements or statistical clusterings of attributes. Most often, the average artifact, rather than the variation between individual examples, is the ultimate objective of the definition. A classifier who finds a group, or even an individual artifact, that deviates at all conspicuously from the norm often erects a new analytical type. “Splitters” tend to proliferate types, and “lumpers” do the opposite. The whole operation is more or less objective (Dunnell, 1971).

Types

All of us have feelings and reactions about any artifact, whether it is a magnificent wooden helmet from the Pacific Northwest coast (see [Figure 10.3](#)) or a simple acorn pounder from the southern California interior. Our immediate instinct is to look at and classify these and other prehistoric artifacts from our own cultural standpoint. That is, of course, what prehistoric peoples did as well. The owners of the tools that archaeologists study classified them into groups for themselves, each one having a definite role in their society. For example, in eating we assign different roles to a knife, fork, and spoon. Knives cut meat; steak knives are used for eating steaks. The prehistoric arrowhead is employed in the chase; one type of missile head is used to hunt deer, another to shoot birds, and so on. The use of an artifact may be determined not only by convenience and practical considerations but also by custom or regulation. The light-barbed spearheads used by some Australian hunting bands to catch fish are too fragile for dispatching a kangaroo, but the special barbs permit the impaled fish to be lifted out of the water. Pots are made by women in most African and Native American societies, which have division of labor by sex; each has formed complicated customs, regulations, or taboos, which, functional considerations apart, categorize clay pots into different types with varying uses and rules in the culture.

Furthermore, each society has its own conception of what a

particular artifact should look like. Americans have generally driven larger cars; Europeans prefer small ones. These preferences reflect not only pragmatic considerations of road width and longer distances in the New World but also differing attitudes toward traveling, and for many Americans, a preoccupation with prestige manifested in gold-leaf lettering, custom colors, hubcaps, and style. The steering wheel is on the left, and the car is equipped with turn signals and seat belts by law. In other words, we know what we want and expect an automobile to look like, even though minor design details change—as do the length of women’s skirts and the width of men’s ties.

Because archaeologists devise archaeological types that are appropriate to the research problems they are tackling and that facilitate comparison with other groups, a type may or may not coincide with the actual groupings designated by the original makers or with their uses of the tools. A good example comes from the world-famous Olduvai Gorge site in East Africa, where Louis and Mary Leakey excavated a series of cache sites used by very early humans, early *Homo*. Mary Leakey studied the stone tools and grouped them in the **Oldowan** tradition, a tradition characterized by jagged-edged chopping tools and flakes (Leakey, 1973). (For Olduvai Gorge, see Site box on page 194.) She based her classifications on close examination of the artifacts and an assumption that the first human tool kit was based on crude stone choppers soon became archaeological dogma.

Doing Archaeology Archaeological Types

Archaeologists tend to use three “types of types,” described briefly here, which, in practice, are rarely separated one from another, for experts tend to draw this kind of information from more general classifications of artifacts (Steward, 1955) (Figure 10.4).

Descriptive types are based solely on the form of the artifact—physical or external properties. The descriptive type is employed when the use or cultural significance of the object or practice is unknown. Descriptive types are commonly used for artifacts from early prehistory, when functional interpretations are much harder to reach.

Chronological types are also defined by decoration or form, but they are time markers. They are defined in terms of attributes that show change over time. For example, on the Great Plains of North America,

Clovis and Folsom points were used for short periods of prehistoric time, the former for about three and a half centuries from about 11,300 to 10,950 B.C. (see [Figure 11.7d](#) on page 204). Folsom dates to between about 9880–8250 B.C. Projectile points have long been used as chronological markers in North American archaeology.

The great Egyptologist Flinders Petrie used chronological types when he studied the predynastic jars from Diospolis Parva on the Nile (see [Chapter 7](#)). Chronological types figure prominently in archaeology of the American Southwest and were used by Alfred Kidder (1924) in his classic excavations at Pecos. Such types have the disadvantage that they are often hard for an archaeologist other than their originator to duplicate due to poor definitions of different types, except under favorable conditions or by archaeologists who have received identical extensive training (Sackett, 1977).

Functional types are based on cultural use or role in their user's culture rather than on outward form or chronological position—for example, “weapons,” “clothing,” “food preparation,” and so on. Ideally, functional types should reflect the precise roles and functional classifications made by the members of the society from which they came. Needless to say, such an objective is very difficult to achieve because of incomplete preservation and lack of written records. We have no means of visualizing the complex roles that some artifacts achieved in prehistoric society. Although in some cases obvious functional roles, such as that of an arrowhead for hunting or warfare or of a pot for carrying water, can be correctly established in the laboratory, functional classifications are necessarily restricted and limited.

Let us consider a Scandinavian flint dagger ([Figure 10.5](#))—a beautifully made pressure-flaked tool that was a copy of the bronze daggers that were so fashionable around 2000 B.C. in central Europe. This tool has been classified by generations of archaeologists as a dagger, by implication a weapon of war and defense, worn by Scandinavian farmers who still had no metal and made a slavish imitation of a more advanced metal tool. This instinctive designation may seem obvious, but we really do not know whether our functional classification is correct. Does use-wear on the blade show that a dagger was actually used in warfare and for personal defense? Was it a

weapon, or was it purely an object of prestige for the owner, perhaps with some religious function?

Figure 10.4 Some 9,000-year-old stone artifacts from Star Carr, England (actual size). You can classify these by descriptive type as geometric stone tools; by chronological type as Mesolithic microliths, Star Carr forms; and by functional type as microlithic arrowhead barbs.

Stylistic types are best exemplified by items such as clothing, because style is often used to convey information through public display. The Aztecs of central Mexico lived in a ranked society in which everyone's dress was carefully regulated by sumptuary laws (Anawalt, 1981). Thus, a glance at the noble in the marketplace could reveal not only his rank but also the number of prisoners he had taken in battle and many other subtle distinctions. Even the gods had their own regalia and costumes that reflected their roles in the pantheon (Townsend, 2009). Stylistic types, which may result in a grouping entirely different from a grouping based on functional types, are not used often in archaeological classification, except when historical records are available (Conkey and Hastorf, 1990).

Figure 10.5 Flint daggers from Hindsgavl, Denmark, c. 1800 B.C. , displayed in the National Museum of Denmark, Copenhagen.

Source: Courtesy of Marcin Rogozinski/Alamy Stock Photo.

Subsequently, Nicholas Toth of Indiana University took a radically different approach to classifying Oldowan artifacts (Toth and Schick, 1993). He has spent many hours not only studying and classifying the original artifacts but also learning Oldowan technology for himself, replicating hundreds of artifacts made by early *Homo* 2 million years ago. His controlled experiments have shown that early *Homo* was not using chopping tools at all. The primeval stone workers were more interested in the sharp-edged flakes they knocked off lumps of lava for cutting and butchering the meat they scavenged from predator kills. The "chopping tools" were, in fact, just cores or the end product of knocking flakes off convenient lumps of lava. Controlled experiments like Toth's provide useful insights into how prehistoric peoples manufactured the tools they needed. Toth and other experts are now

trying to study the telltale patterns of edge wear on the cutting edges of Oldowan flakes; for the polish, striations, and microflake scars left by working, for example, fresh bone as opposed to hide or wood are highly distinctive. With controlled experimentation and careful examination of edge wear, they hope to achieve a closer marriage between the ways in which the first humans used stone tools and the classifications devised by archaeologists hundreds of thousands of years later.

Figure 10.6 Jaguar/human head from Chavín de Huantar, Peru.

Source: Courtesy of age fotostock/Alamy Stock Photo.

Everyone agrees that a type is based on clusters of similar attributes or on clusters of objects. Although patterns of attributes may be fairly easy to identify, how do archaeologists know what is a type and what is not? Should they try to reproduce the categories of pot that the makers themselves conceived? Or should they just go ahead and create “archaeological” types designed purely for analytical purposes? Herein lies the hub of the controversy about types in archaeology (see the Doing Archaeology box).

The archaeologist constructs typologies based on the recurrence of formal patterns of physical features of artifacts. Many of these formal types have restricted distributions in space and time, which suggests that they represent distinctive “styles” of construction or tasks that were carried out in the culture to which they belong. For example, the so-called **Chavín** art style was widespread over much of coastal and highland Peru after 900 B.C. The jaguar, snake, and human forms of this art are highly characteristic and mark the spread of a distinctive iconography over a large area of the Andean region. Chavín art, and the characteristic styles associated with it, had a specific role in Peruvian society of the time (Figure 10.6).

Processes of Archaeological Classification

As we have emphasized, archaeological classification is the ordering of data on the basis of shared characteristics. But how do archaeologists go about this process? Traditionally, classification has been based on the archaeologist’s “concept of types,” once the subject of one of the great

controversies in archaeology (Dunnell, 1986). On a formal level, a type can be defined as “a group or class of items that is internally cohesive and separated from other groups by one or more discontinuities” (Whallon and Brown, 1982). Until the late 1950s, almost all archaeological classification was qualitative, based to a great extent on instinct and experience rather than on numerical methods or empirical testing. The new perspectives on the archaeological record that emerged in the 1960s coincided with a new generation of quantitative techniques that bear on the traditional problem of archaeological classification, techniques that are revolutionizing typology. (For a comprehensive discussion, see Shennan, 1988.)

Quantitative Methods

The concept of quantitative methods has great breadth in archaeology. It refers not only to the standard techniques of statistical analysis and inference that readily come to mind but also to various techniques of numerical analysis and manipulation, as well as graphical techniques for displaying data so that the patterns in the data are more readily apparent. Modern archaeology relies heavily on all manner of quantitative methods. In fact, quantitative methods are now central to archaeology in that the descriptive and explanatory power inherent in those methods and the carefully structured reasoning behind the methods provide us with powerful tools for answering such fundamental questions as “How old is it?,” “Where does it come from?,” and “What was it used for?”

An understanding of the process of applying quantitative methods to archaeological problems and a basic level of computer literacy are fundamental skills for all modern archaeologists (Drennan, 2009). In general, however, some sophisticated techniques are performed almost routinely by most practicing archaeologists today.

There are three fundamental issues in applying quantitative methods to archaeological problems. The first is realizing when quantitative methods can aid in resolving a problem. The second is being familiar enough with various techniques and their underlying assumptions to know which techniques are appropriate to specific kinds of archaeological problems. Finally, the third is being familiar enough

with the data, methods, and general anthropological theory to formulate a reasonable interpretation of the analytical results that has meaning in terms of the ultimate topic of archaeology—human behavior.

Quantitative methods are valuable in archaeology in three broad areas: data exploration and characterization, data description, and hypothesis testing or confirmation. It is important to keep in mind the distinction between descriptive techniques and confirmatory, or inferential, techniques. The former term applies to economical methods of describing sets of data in ways that are useful to other researchers and that preserve the inherent structure of the data. The latter refers to methods aimed at inferring the characteristics of an unobservable population on the basis of the characteristics of a sample taken from that population and providing some guide as to the reliability of the inference. (For an example, see the Doing Archaeology box).

Exploration In recent years, a new suite of analytical tools has been added to the archaeologist's repertoire. These tools rely on a slightly different way of thinking about archaeological data, as well as new ways of looking at the data. Collectively known as **exploratory data analysis (EDA)**, these techniques have been specifically designed to aid in detecting patterns and deviations in sets of data by relying heavily on visual displays of data rather than on summary statistics and statistical significance tests.

Two basic principles lie behind these techniques. First, the fastest, most sophisticated pattern-recognition hardware and software known are the human eye and brain. To the extent that large quantities of data can be reorganized and presented in a graphical rather than numerical form, the researcher can more readily detect patterns and deviations in the data that may have important implications for the problem at hand.

The second principle is a basic assumption about the structure of data sets. In EDA parlance, a set of observations can be divided into a general pattern, sometimes called the "smooth," and deviations from that pattern, the "rough." The smooth is important for understanding the general distribution of the data and the phenomena responsible for the observed regularity. The rough is important for potentially pointing out either unique events or perturbations in the normal operation of the

system.

These techniques for analyzing data have a very compelling application in archaeology, particularly in the area of typology, where the ultimate goal of the analysis is to identify regular patterns in the artifactual data that may reveal patterning in the human behavior that produced or distributed the artifacts. Exploratory data analysis is useful for reducing masses of data to some kind of observable order, usually in the form of frequency distributions, to obtain an initial impression of the rough and the smooth. Any number of graphical devices may be used, including bar charts, histograms, frequency curves, box plots, and stem-and-leaf plots. These graphics can give the researcher valuable insights into the structure of the data, point up possible relationships between variables, and suggest appropriate techniques for later descriptive or confirmatory analysis. (For an excellent discussion of EDA, see Shennan, 1988.)

Description Descriptive statistics aid in the economical presentation of facets of the archaeological record. These techniques provide a means for organizing and quantifying archaeological data in a manner that facilitates objective comparison while preserving the inherent structure of the data. Descriptive statistics provide archaeologists with an economical way of indicating the numbers and kinds of artifacts found at a site or the dimensions of artifacts and the degree of variation in those dimensions. They provide a means of taking masses of data stored in computer databases and summarizing them in a readily digestible form. Today, descriptive statistics are often employed on-site as an aid to excavation or survey. The basic data are often collected and entered into a computer database in the field laboratory on a daily basis. Those data can then be quickly summarized using basic descriptive techniques to indicate differences in the frequency of artifacts between excavation areas or levels or to indicate emergent patterns in survey data that can then be used to refine field techniques and strategies. Use of descriptive statistics generally involves summarizing sets of data using very straightforward measures of the structure of the data. They include such things as measures of central tendency (mean, median, mode) and measures of dispersion (standard deviation, spread, range), as well as basic graphical devices such as bar graphs, histograms, and line graphs.

Doing Archaeology Computing the Anglo-Saxon Dead

The early Anglo-Saxon cemetery of Cleatham in Lincolnshire, England, was excavated in the 1980s, but extensive computer-aided (quantitative) analysis of the finds has only recently taken place (Leahy, 2007).

Cleatham yielded some 1,204 funerary urns and 62 inhumations. The cemetery originally contained an estimated 1,528 burials making it the third largest Anglo-Saxon cemetery in Britain ([Figure 10.7](#)).

During excavation there was no sampling. Instead, the archaeologists excavated and recorded every (visible) piece of material with the idea that even a few crumbly bits of pot in the fill of a grave might yield vital clues about the sequencing of burials. They recorded a vast amount of data—including thousands of fragments of beads, brooches, and potshards. They then transferred this information onto a computer database.

So what has the computer analysis revealed? First, it has provided a chronological sequence for decorated urns, since on some parts of the site as many as seven urns had been placed one on top of the other at different periods between the fifth and seventh centuries A.D., while elsewhere as many as five pots had been placed in the ground side by side at the same time. Such stratigraphic relationships between pots bearing contrasting designs are the very essence of chronological sequencing. Second, because of the relationships between the stratigraphic sequence, the pots containing burnt bone, and grave goods (bone combs, bronze brooches, glass beads), it was also possible to organize the latter into a tight chronological sequence. Third, it was found that many of both decorated pots and other artifacts were similar to objects found elsewhere in Anglo-Saxon England, indicating the extent to which ideas traveled, artistic concepts were shared, and a single cultural *koine* existed across large areas of the country in this period. Some of the links were remarkable. Urns were found that had direct parallels up to 87 miles (140 km) away—indicating that they had actually been made by the same potter. Other contacts implicit in the grave assemblages were more wide-ranging and indeed international. Fragments of ivory bag-rings were found, the ivory probably coming from Africa. Cowrie shells and coral were also brought from the Indian Ocean. These exotic objects must have been passed from trader to

trader across Europe to reach darkest Lincolnshire.

The data from Cleatham are all uploaded onto the Internet and are providing an excellent resource for those researching this era (see: http://ads.ahds.ac.uk/catalogue/resources.html?cleatham_cba_2007.)

Figure 10.7 The Anglo-Saxon cemetery at Cleatham, England.

Source: Courtesy of Kevin Leahy.

In archaeology, the ultimate goal of descriptive statistics is to organize data into a more manageable form in order to facilitate comparison and indicate patterning. It is one of the oldest and simplest sets of techniques of quantitative analysis for archaeologists and remains one of the most frequently used because of its simplicity and power. In innumerable archaeological problems, basic descriptive statistics is all that is required to characterize the data adequately and to provide meaningful interpretive information on the problem.

Hypothesis Testing (Confirmation) Confirmatory (inferential) statistics are designed to allow the researcher to make informed inferences about the characteristics of a population or the relationship between variables on the basis of data collected from a sample of the population of interest. All the various confirmatory techniques provide a summary statistic that indicates how reliable the inference is likely to be. Archaeologists are concerned with making inferences about the past on the basis of patterns and relationships evident in the archaeological record. However, because the relationship between the observable phenomena (the archaeological record) and the unobservable phenomena of real interest (past human behavior) is often a very imperfect one, archaeologists need to know how reliable their inferences are. Since we cannot go back in a time machine to see for ourselves whether our inferences are valid, we must rely on mathematics and the known laws of probability. As Stephen Shennan (1988) put it, “The area where mathematics meets the messier parts of the real world is usually statistics.”

S i T E > Olduvai Gorge, Tanzania <

Olduvai Gorge is a deep gash cut into the Serengeti Plains of Tanzania,

East Africa, by an ancient earth movement (see [Figure 10.8](#)). By chance, the gash cuts through the deposits of a long-dried-up shallow lake, where very early humans once scavenged for food. German paleontologist Hans Reck was the first scientist to visit Olduvai. He collected the bones of fossil elephants and other mammals from the lake beds in the 1920s. In 1931, Louis Leakey visited the gorge for the first time and soon collected magnificent stone axes from the same deposits. From that year until the 1950s, Louis and Mary Leakey worked occasionally at Olduvai, recovering thousands of stone artifacts, which Mary studied in relation to the stratified lake beds where they were found (L. Leakey, 1951; M. Leakey, 1973).

The gorge cuts through the shores of the lake, where hominins scavenged on predator kills by the shallow water for tens of thousands of years. There are four major, stratified lake bed formations at Olduvai, the lowest of them lying on a bed of hardened volcanic ash potassium-argon dated to about 2 million years ago. *Zinjanthropus boisei* and *Homo habilis* come from the lowest formation, known as Bed I, both found in association with small scatters of stone fragments and broken animal bones, places where the hominins broke up bones and ate fresh meat before moving on.

Over many years, Mary Leakey developed a remarkable artifact sequence at Olduvai, based on thousands of stratified tools. The earliest visitors to Olduvai made the simple flakes and crude “choppers” described in this chapter. Subsequently, hominin technology became more refined as the first crude stone axes appeared and were succeeded by progressively more refined axes and cleaving tools, multipurpose artifacts used for butchering animals. Mary’s studies chronicled the slow evolution of stone technology in East Africa, from soon after this early toolmaking more than 2.5 million years ago until long after more advanced archaic humans such as *Homo erectus/ergaster* flourished on the African savanna. Though we now have evidence for even earlier (and more basic) stone tools—dated to 3.3 million years ago and found in 2012 at the site of Lomekwi 3 in West Turkana, Kenya (Lewis and Harmand, 2016)—Olduvai is still the longest-known sequence of stone tool technology in the world.

[Figure 10.8](#) Olduvai Gorge, Tanzania.

Source: Courtesy of John Warburton-Lee Photography/Alamy Stock Photo.

The tricky part about employing any of the various univariate and multivariate techniques of inferential statistics is that the test statistic (student's t , F test, chi-square, etc.) is measuring only the reliability of the mathematical relationship between variables in a data set, between a sample and its presumed population, or among data sets. How inferences about those mathematical relationships are interpreted in terms of the actualities of the archaeological record or human behavior depends on the archaeologist.

In the final analysis, quantitative methods enable archaeologists to organize their artifact and other data in intelligent, efficient, and replicable ways, allowing them to view the data more clearly and objectively as they work toward the goal of discerning patterns that relate to past human behavior. These techniques also allow archaeologists to evaluate objectively the reliability of their inferences from small samples to larger populations of archaeological entities, as well as inferences about the interrelations among variables. To the extent that these techniques are applied to attribute and object pattern recognition, they are extremely valuable aids to artifact classification.

Quantitative methods have been applied to two contrasting approaches to artifact classification, both of which were in use before the advent of computers and statistical methods in archaeology: attribute analysis and object clustering.

Attribute Analysis Attribute analysis emphasizes combinations of attributes that distinguish and isolate one artifact type from another. The physical characteristics or features of significance used to distinguish one artifact from another are known as **attributes** (Whallon and Brown, 1982). As archaeologists work out their typologies, they find themselves examining hundreds of individual fragments, each of which bears several distinctive attributes (see [Figure 10.9](#)). Every commonplace artifact we use can be examined by its attributes. The familiar glass beer mug has a curved handle that extends from near the lip to the base, often fluted sides, a straight, rounded rim, and dimensions that are set by the amount of beer it is intended to contain. It is manufactured of clear, relatively thick glass (the thickness can be

defined by precise measurement).

You can find numerous attributes on any human artifact, be it a diamond ring or a prehistoric pot. For example, a collection of 50 potsherds lying on a laboratory table may bear black-painted designs; 8 of them may have red panels on the neck, 10 may have shallow bowls, and so on. An individual potsherd may come from a vessel made of bright red clay mixed with powdered seashells so that the clay would fire better. It may come from a pot with a thick rim made by applying a rolled circle of clay before firing, and a crisscross design cut into the wet clay with a sharp knife during manufacture. Each of the many individual features is an attribute, most of which are obvious enough. Only a critically selected few of these attributes, however, will be used in classifying the artifacts. (If all were used, then no classification would be possible: Each artifact would be an individual object identified by its unique combination of attributes.) Thus, the archaeologist works with only those attributes considered most appropriate for the classificatory task at hand.

Figure 10.9 Some common attributes of a clay vessel. Specific attributes that could be listed for this pot are concave shoulder, dot-and-drag decoration, mica temper, round base, and thickness of wall at base.

Three broad groups of attributes are in common use:

- **Formal attributes** are such features as the shape of the artifact, its measurable dimensions, and its components. Usually they are fairly obvious.
- **Stylistic attributes** involve decoration, color, surface finish, and so on (Sackett, 1977).
- **Technological attributes** include the material used to make an artifact and the way it was made.

The selection of attributes normally proceeds through a close examination of a collection of artifacts. Exploratory data analysis techniques can be useful in helping to determine which attributes provide the most diagnostic discrimination. A group of potsherds can be divided into different decorative styles based on shape, surface, and color. The selected attributes are then hand recorded, and a series of

artifact types is erected from them. The definition of the type here can depend on the order in which the attributes are examined and on the researcher's decision as to which are important.

Statistical typologies are derived from attribute clusters, usually coded on a computer, which are then used to divide the artifact collection into categories defined by statistically derived attribute clusters. James Sackett (1966) used this approach on 32,000-year-old Aurignacian end scrapers from Upper Paleolithic sites in southwestern France and found that the extent and location of trimming on the edges and the angle between the two longer sides were important variables that may have defined classes of artifacts used for different purposes.

Object Clustering The **object clustering** approach to classification begins with a series of so-called **operational taxonomic units (OTUs)**, usually artifacts (Cowgill, 1982). The archaeologist calculates the similarities between all possible pairs of objects using similarity coefficients. On the basis of similarity scores, the analyst can then link the OTUs into a hierarchical structure, which ranges all the way from complete uniqueness of all artifacts (an unanalyzed collection) to complete unity, when all OTUs are in the same cluster. Object clustering does use attributes, but in contrast to attribute approaches, it uses them to assess the similarity between objects, not the associations between attributes. (Cowgill, 1982, describes the differences between the two approaches.) Object clustering classifications are based on a quantitative approach known as *cluster analysis*, a form of numerical taxonomy.

Each approach to classification supplies different information about the very structure of archaeological data, all of which is valuable. In a sense, the approaches are descriptions of the structure in archaeological data, based, in their quantitative guises, on a greater concern for techniques for discovering variations in artifacts than on the actual selection of attributes for comparison. At present, there is still little theoretical justification for selecting the attributes that are used to classify artifacts or to cluster them.

Assemblages and Patterns

Culture history in archaeology is based on classification of artifacts and assemblages, defined as associations of artifacts that are thought to be contemporaneous. This was the approach espoused by V. Gordon Childe in the 1930s and 1940s and was also popular in North America. “We find certain types of remains ... constantly recurring together,” Childe (1925: 15) wrote. “Such a complex of regularly associated traits we shall term ... a ‘culture.’ We may assume that such a complex is the material expression of what would today be called a ‘people.’” This assumption was virtually archaeological law until the 1950s, when a number of prehistorians began using statistical methods to look at assemblages of artifacts.

These earlier archaeologists had assumed a steady, almost inevitable progression of human culture through the ages. They assumed that artifact assemblages with recurring patterns were merely traces of cultural “species” that extended far back into antiquity. This “organic” view of culture history regarded assemblages of artifacts as distinct categories, such as organic species that did not modify their form from one context to the next (Sackett, 1977). The argument went on to assume that a specific cultural tradition leads to only one characteristic type of industry in the archaeological record that is circumscribed in time and space.

What Do Assemblages and Patterns Mean?

The “organic” view of the past is a highly organized scheme, rather like the medieval “Chain of Being” in early biology, in which every living thing had its place in the general scheme of things. American archaeologists have generally preferred a more “cultural” perspective, making considerable use of data on artifacts and other culture traits known to have been used by living societies in North America. Observation of these data has shown a strong correlation between the distributions of distinctive cultural forms and different environments. For example, plank houses and an elaborate canoe technology are characteristic of the peoples of the Pacific Northwest coast, where readily split cedar and other trees flourished in abundance. In contrast, desert peoples in the Great Basin lived in much more transitory settlements of brush shelters and houses, using a highly portable tool

kit adapted to a mobile desert lifeway. It is all very well to say that such correlations were true of historic times, but what about earlier prehistory? Can one say that artifact assemblages from the Great Basin dating to 5,000 years ago reflect similar adaptations, similar social groups? Were conditions different in the past from today? Can one use modern artifact patternings as a basis for interpreting ancient behavior?

Observations of living societies, such as Lewis Binford's research on the Nunamiut caribou hunters in Alaska, have shown that it may not be possible to distinguish among ethnic and cultural groups from artifact assemblages alone (Binford, 1978). Thus, the role of classification in archaeology is shifting away from organic viewpoints that consider artifacts and cultures as finite in time and space to problem-oriented classifications that concentrate not only on individual tools but also on entire assemblages, and their patterns in archaeological sites. In other words, classification alone is meaningless, unless the classifications are interpreted in terms of other data. This is where middle-range theory comes in (see [Chapter 14](#)).

Artifact classifications are still carried out, for the most part, using approaches meant for reconstructing culture history, formulations of time and space that owe much to functional classifications of artifacts based on common sense (Dunnell, 1978). Thus, the same classificatory units have remained in use, while archaeologists pay lip service to newer approaches. As Dunnell (1986) pointed out, the question of questions is a simple one: Can style be explained within a scientific and evolutionary framework, using laws of culture change? So far, such a theoretical framework does not exist.

Summary

1. The first stage in laboratory analysis is processing field data into a form that will enable one to analyze and interpret them. The finds are also inventoried during this stage.
2. Classifying artifacts in archaeology is somewhat different from our day-to-day classification of the objects around us. Two systems of classification are taxonomy and systematics.
3. Taxonomy is a classification system of concepts and terms used

by many sciences, archaeology among them. Systematics is a way of creating units of classification that can be used to categorize things as a basis for explaining archaeological or other phenomena.

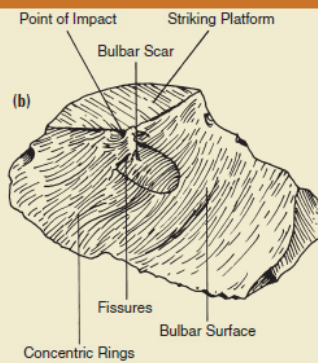
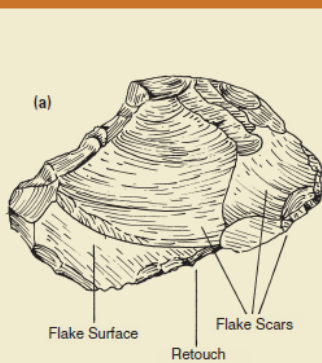
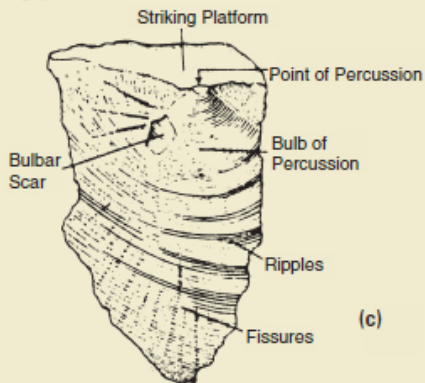
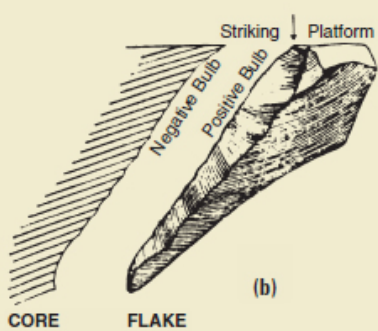
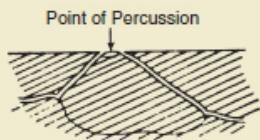
4. The objectives of archaeological classification are to organize data into manageable units, describe types, and identify relationships among types.
5. Archaeological types are groupings of artifacts created for comparisons with other groups. These groupings may or may not coincide with the actual tool types designed by the manufacturers.
6. Types are based on clusters of attributes. Four “types of types” are commonly used today:
 - a. Descriptive types are based on the form of the artifacts, using physical or external properties.
 - b. Chronological types are defined by form, but are time markers.
 - c. Functional types are based on cultural use or role rather than outward form or chronological position.
 - d. Stylistic types use changing styles for classification purposes.
7. Archaeological classification begins with identifying artifact attributes, the characteristics that distinguish one artifact from another. Formal attributes are such features as the shape of an artifact, and technological attributes include the materials used to make an artifact and manufacturing methods. Attributes can be selected by closely examining a collection of artifacts, or they can be derived statistically.
8. Statistically based classifications are now in common use, based on quantitative analyses, including the use of EDA. Attribute and object cluster classifications are two major approaches now based on quantitative methods.
9. Culture history in archaeology is based on classification of artifacts and assemblages, defined as associations of artifacts that are thought to be contemporaneous. This “organic” view of

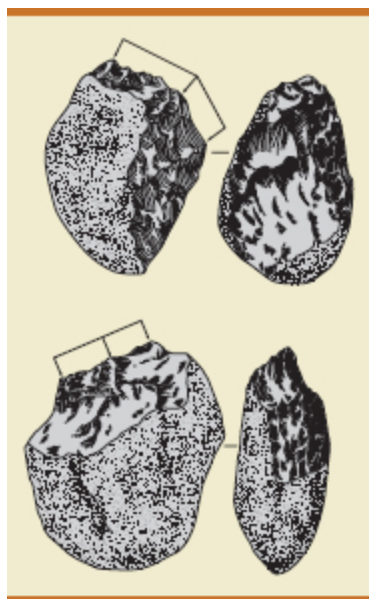
culture history has been replaced by a more “cultural” viewpoint in which environment and culture play important roles.

Further Reading

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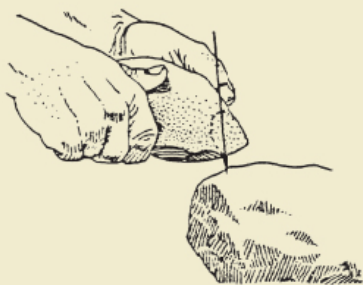




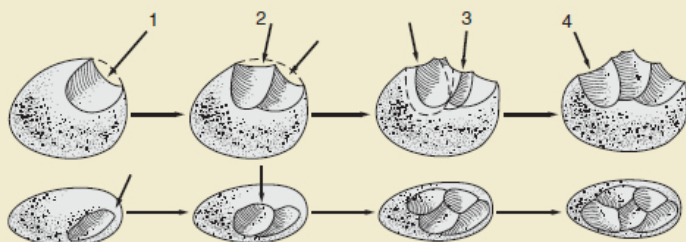




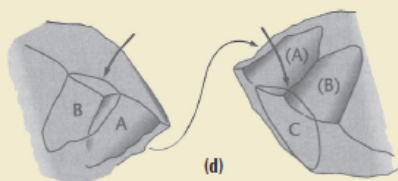
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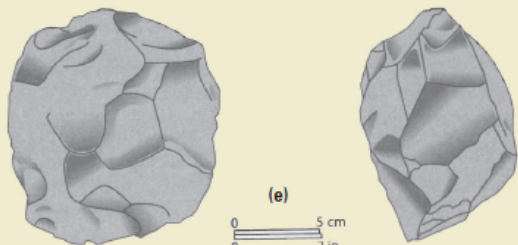
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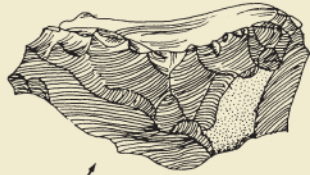
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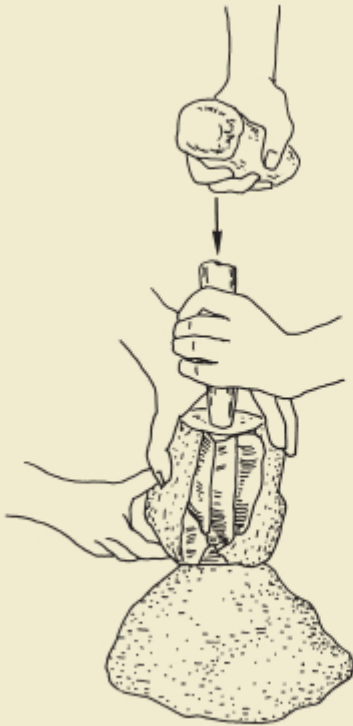


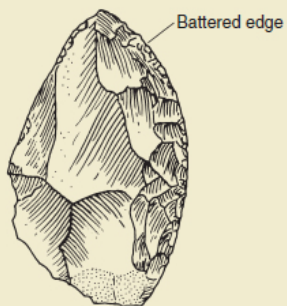
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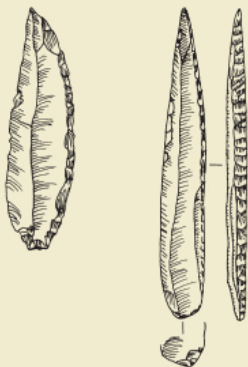
When placed with the flat surface downward, core sometimes looks like a tortoise shell

Side





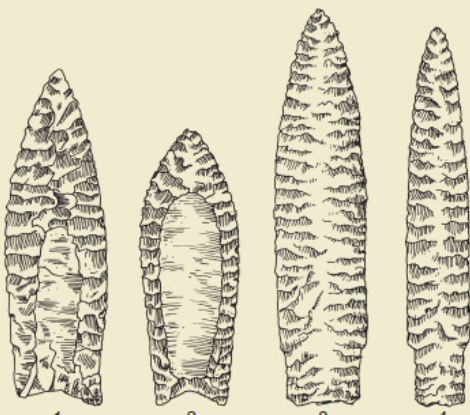
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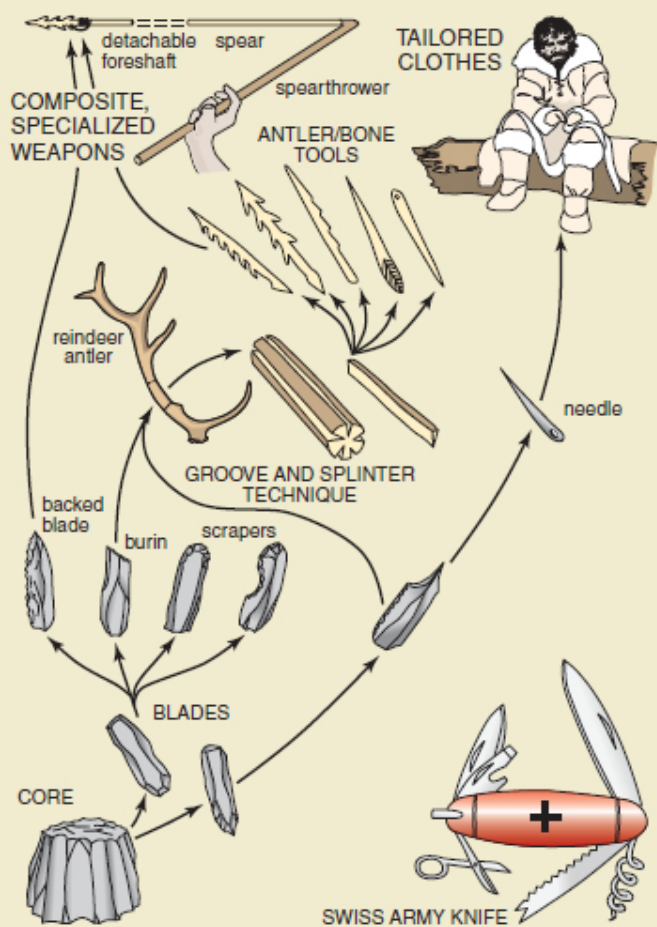


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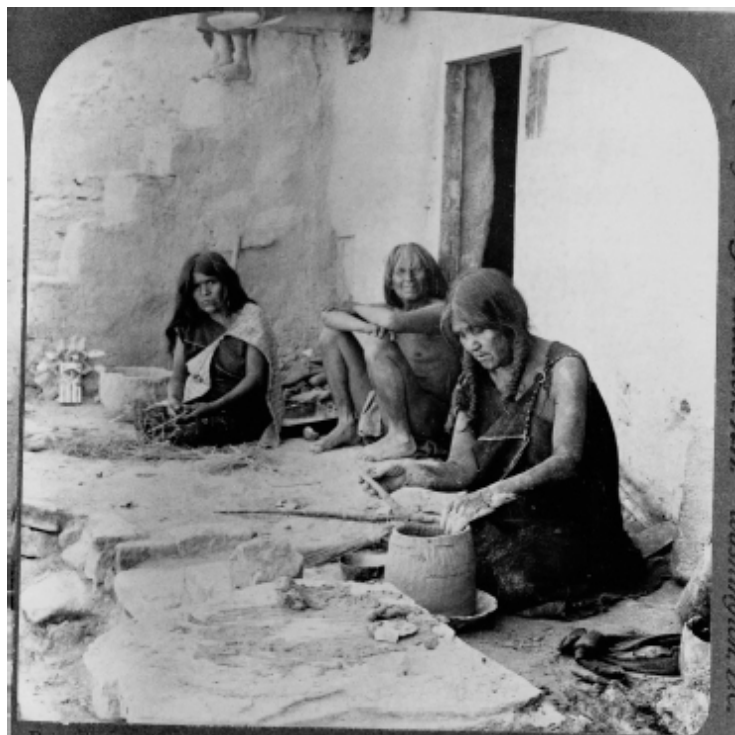


(c)









Primitive methods—a Hopi Squaw coiling clay into pottery—Oraibi, Ariz.
Copyright 1902 by Underwood & Underwood.















11

Technologies of the Ancients

CHAPTER OUTLINE

Stone

Clay (Ceramics)

Metals and Metallurgy

Bone

Wood

Basketry and Textiles

Assyrian woman from Nimrud, Iraq. From the Palace of Shalmaneser, 858–824 B.C.

Source: Courtesy of Iraq Museum, Baghdad/Bridgeman Images.

The technological achievements of humanity over the past 3 million years of cultural evolution have been both impressive and terrifying. Today we can land an astronaut on the moon, transplant human hearts, and build sophisticated computers. Yet in the final analysis, our contemporary armory of lasers, atomic bombs, household appliances, and every conceivable artifact designed for a multitude of specialized needs has evolved in a direct, albeit branching, way from the first simple tools made by the earliest human beings. This chapter examines some of the main technologies used by prehistoric peoples to adapt to, and extend their use of, their natural environments and looks at some of the ways in which archaeologists study them.

Stone

Bone, plant fiber, wood, and some kinds of rock have been the primary raw materials for human technology for most of human existence. Metallurgy is but a recent development, and stone tools have provided the foundation for classification of many prehistoric cultures since scientific archaeology began. The raw material itself set severe limits on peoples' technological achievements for much of history, and the evolution of stoneworking over millions of years was infinitely slow. Nonetheless, people eventually exploited almost every possibility afforded by suitable rocks for making implements (Odell, 2003).

Working Stone

The manufacture of stone tools is what is called a **reductive** (or

subtractive) technology, for stone is acquired, then shaped by removing flakes until the desired form is achieved. Obviously, the more complex the artifact, the more reduction is required to make it. Basically, the process of tool manufacture is linear. The stoneworker acquires the raw material, prepares a lump of stone (the **core**), then carries out the initial reduction by removing a series of flakes. These flakes are then trimmed and shaped further, depending on the artifact required. Later, after use, a tool may be resharpened or modified for another use.

Principles of Manufacture The simplest way of producing a stone that will cut or chop, surely the basic tool produced by prehistoric peoples, is simply to break off a piece and use the resulting sharp edge. But to make a tool that has a more specialized use or can be employed for several purposes requires a slightly more sophisticated flaking technique. First, an angular fragment or smooth pebble of suitable rock can be brought to the desired shape by systematically flaking it with another stone. The flakes removed from this core are then primarily waste products, whereas the core becomes the implement that is the intentional end product of the toolmaker. Furthermore, the flakes struck from the core can themselves be used as sharp-edged knives, or they can be further modified to make other artifacts. From this simple beginning, many complex stone industries have evolved, the earliest tools being simple—many of them virtually indistinguishable from naturally fractured rock (Crabtree, 1972).

DISCOVERY *Zinjanthropus boisei* at Olduvai Gorge, Tanzania, 1959

It was a blazing hot day at Olduvai Gorge, East Africa, in 1959. Back in camp, Louis Leakey lay in his tent, suffering from a bout of influenza. Meanwhile, Mary Leakey, sheltered by a beach umbrella, was excavating the small scattering of broken animal bones and crude stone artifacts deep in the gorge. For hours, she brushed and pried away dry soil. Suddenly, she unearthed part of an upper jaw with teeth so humanlike that she took a closer look. Moments later, she jumped into her Land Rover and sped up the rough track to camp. “Louis, Louis,” she cried, as she burst into their tent. “I’ve found Dear Boy at last.”

Louis leapt out of bed, his flu forgotten. Together, they excavated the fragmentary remains of a magnificent robust hominin skull. The Leakeys named it *Zinjanthropus boisei* (“African human of Boise,” a Mr. Boise being one of their benefactors), now known as *Australopithecus boisei*.

Zinjanthropus was the first of a series of very early human fossils discovered by Louis and Mary Leakey at Olduvai Gorge in the years that followed. Between them, they unearthed another, much more lightly built human that they named *Homo habilis*, “Handy Person,” as they were convinced it was the first human toolmaker.

The Leakeys worked with shoestring budgets until their *Zinjanthropus* discovery gave them access to National Geographic Society funding. Since their magnificent discovery, the search for our earliest ancestors has become an international enterprise, which is revealing a far greater variety of prospective early human ancestors than anyone imagined back in 1959.

DISCOVERY Finding the Oldest Known Stone Tools, 2012

When did hominins first start making stone tools? It’s an important question since archaeologists tend to place the start of “culture” with the start of stone tool making. Until very recently, the so-called Oldowan tools took that title (named after the Olduvai Gorge, where they were first discovered). Dated to roughly 2.6–1.5 million years ago, these coarsely chipped Oldowan tools are a critical chapter in human development. Contemporary with *Homo habilis* (the “handy-person”), it was assumed that making stone tools was a unique and fundamental attribute of our genus.

However, in 2012, a team working at Lomekwi 3 in West Turkana, Kenya, found evidence for even earlier and yet more basic tools dating to 3.3. million years ago (Lewis and Harmand, 2016). Aside from pushing back the date for tool use by quite a considerable stretch, these tools predate the emergence of our genus, *Homo*. Instead, the finders (Harmand et al., 2015) suggest they might be the work of local hominins, *A./Kenyanthropus platyops*. (Note that the A. stands for *Australopithecus*, though its australopithecine status is uncertain, hence the alternative use of “*Kenyanthropus*.”)

Yes, early human evolution is a complicated business, and this

“game-changing” discovery is currently under close scrutiny. For now, it is important to be aware of these early tools, which incidentally come hot on the heels of the discovery of cut marks, also presumed to have been made by stone tools, on animal bones from Dikika, Ethiopia, and dated to an even earlier 3.4 Ma (McPherron et al., 2010). As a result of these finds, it is no longer viable to maintain that stone tools were exclusive to our genus, even though they flourished greatly in association with *Homo*.

In general, Stone Age people and other makers of stone tools chose flint, obsidian, and other hard, homogeneous rocks from which to fashion their artifacts. All of these rocks break in a systematic or predictable way, like glass. The effect is similar to that of a hole in a window produced by a BB gun. A sharp blow by percussion or pressure directed vertically at a point on the surface of a suitable stone dislodges a flake, with its apex at the point where the hammer hit the stone. This method results in a **conchoidal fracture** (see [Figure 11.1](#)). When a blow is directed at a stone slab obliquely from the edge, however, and the break occurs conchoidally, a flake is detached. The fractured face of the flake has a characteristic shape, with a bulge extending from the surface of the piece outward down the side. This is known as the **bulb of percussion** (or of force); there is a corresponding hollow, or flake scar, on the core from which the flake has been detached. The bulb of percussion is readily recognized, as [Figure 11.2](#) shows, not only by the bulge itself but also by the concentric rings that radiate from the center of the impact point, gradually widening away from it.

[Figure 11.1](#) How stone fractures when a blow is struck on homogeneous types of rock: (a) When a blow is struck, a core of percussion is formed by the shock waves rippling through the stone. (b) A flake is formed when the block (or core) is hit at the edge and the stone fractures along the edge of the ripple. (c) Features of a struck flake.

Such deliberate human-made fractures are quite different from those produced by such natural means as frost, extreme heat or cold, water action, or stones falling from a cliff and fracturing boulders below. In these types, the rock sometimes breaks in a similar manner, but most of the flake scars are irregular, and often, instead of concentric rings and a bulb of percussion, a rough depressed area is left on the surface with

concentric rings formed around it.

Distinguishing human-worked from naturally fractured stones requires long experience with stone-tool manufacture, especially when handling very early human artifacts. Our earliest ancestors used the simplest of hard hammer percussion techniques, removing two or three sharp-edged flakes from lava pebbles (see [Figure 11.3](#)). Several famous controversies have raged over alleged “artifacts” found in early Ice Age deposits in Europe and Africa that are contemporary with periods when hominins were already flourishing elsewhere. Under such circumstances, the only sure identification of human-fractured stone implements is to find them in association with fossil human remains and broken animal bones, preferably on living sites.

Figure 11.2 The components of a flake tool: (a) Flake surface. (b) Bulbar surface.

Methods [Figures 11.4](#) through [11.6](#) show some of the major stone-flaking methods prehistoric peoples used. The simplest and earliest was direct fracturing of the stone with a hammerstone (see [Figure 11.4](#)). After thousands of years, people began to make tools flaked on both surfaces, such as Acheulian hand axes (named after the town of Saint Acheul in northern France, where they were first found). As time went on, the stoneworkers began to use bone, “soft” antler, or wood hammers to trim the edges of their hand axes. The hand ax of 150,000 years ago had a symmetrical shape; sharp, tough working edges; and a beautiful finish. As people became more skillful and specialized, such as the hunter-gatherers of about 100,000 years ago, they developed stone technologies producing artifacts for highly specific purposes. They shaped special cores that were carefully prepared to provide one flake or two of a standard size and shape (see [Figure 11.5](#)).

Figure 11.3 These cores, which are from Olduvai Gorge, Tanzania, are some of the earliest forms of human tools. The arrows show the working edges.

Figure 11.4 Among the earliest stoneworking techniques: (a) Using a hammerstone. (b) A variant on the hammerstone, striking a core against a stone block, the so-called anvil technique. (c) The earliest stone tools were made by a simple method. The top row shows the side view: First, two flakes were struck off (1 and 2); second, the stone was turned over, and two more flakes were removed (d); third, a fifth flake completed the useful life of the core (e). The

bottom row shows the process from above.

Figure 11.5 A special core shaped to produce one thin flake. The arrow indicates where the flake was removed. Archaeologists call these Levallois cores, so-named after a suburb of Paris, France, where such cores were first discovered. (One-half actual size.)

About 45,000 years ago, some stoneworkers developed a new technology based on preparing cylindrical cores from which long, parallel-sided blades were removed by indirect percussion with a punch and hammerstone (see [Figure 11.6](#)). These regular blanks were then trimmed into knives, scraping tools, and other specialized artifacts (see [Figure 11.7](#) on page 204). This **blade technology** was so successful that it spread all over the world. It has been shown to be highly efficient (see the Doing Archaeology box). Controlled experiments resulted in 6 percent of the raw material being left on one exhausted blade core; 91 percent of it formed 83 usable blades. Once blades had been removed from their cores, they were trimmed into shape by a variety of techniques. In some, the blade's side was pressure-flaked with an antler or a piece of wood to sharpen or blunt it. Sometimes the flake would be pressed against another stone, a bone, or a piece of wood to produce a steep, stepped edge or a notch (see [Figure 11.7a](#) and [11.7b](#)).

Pressure flaking became so refined that it developed into the most common technique of later times, especially in the Americas (see [Figure 11.7c](#) and [11.7d](#)). The stoneworker used a small billet of wood or antler pressed against the working edge to exert pressure in a limited direction and remove a fine, thin, parallel-sided flake. Eventually, many flake scars formed in this way covered most of the implement's surfaces. Pressure flaking facilitates the production of many standardized tools with extremely effective working edges in a comparatively short time. In southwestern Asia and Europe, and in many parts of Africa and southern and eastern Asia, small blades were fashioned into minute arrowheads, barbs, and adzes, known as microliths, often made using a characteristic notching technique (see [Figure 10.4](#) on page 190). A variant of this technique also evolved in Arctic America and in Australia, where small cores were produced to manufacture diminutive microblades or bladelets.

Figure 11.6 Two uses of the blade technique, employing a punch.

The blade technologies of later times could produce far more tools per pound of material than earlier methods. Later Stone Age peoples ground and polished stone when they needed a sharp and highly durable blade. They shaped the edges by rough flaking and then laboriously polished and ground them against a coarser rock, such as sandstone, to produce a sharp, tough working edge. Modern experiments have demonstrated the greater effectiveness of polished stone axes in felling forest trees, the toughened working edge taking longer to blunt than that of a flaked ax (Townsend, 1969). Polished stone axes became important in many early farming societies, especially in Europe, Asia, Mesoamerica, and parts of temperate North America. They were used in Australia as early as 49,000 years ago, in northern Japan by 30,000 years before present, and in Melanesia and Polynesia for manufacturing canoes, which were essential for fishing and trade.

Figure 11.7 Some methods of trimming stone tools: (a) Steep retouch by battering, on a Mousterian, Middle Paleolithic, sidescraper. (One-half actual size.) (b) Specialized blade tools made by pressing and sharpening the edges. These are backed blades used as spearpoints about 22,000 years ago. (Actual size.) (c) The pressure-flaking technique. (d) Paleo-Indian pressure-flaked points: (1) Clovis point, (2) Folsom point, (3) Scottsbluff point, (4) Eden point.

Expert stoneworkers still fashion artifacts to this day, especially gunflints for use in flintlock muskets. Gunflint manufacture was a flourishing industry in Britain and France into the twentieth century, and it is still practiced in Angola, Africa, where flintlock muskets are used for hunting.

Lithic (Stone-Tool) Analysis

Lithic Analysis Lithic analysis is the term used to describe the study of stone technologies (Andrefsky, 2008; Kooyman, 2001). Early attempts at stone-tool analysis used finished tools, or “type fossils,” which were thought to be representative of different human cultures. This type-fossil approach was abandoned gradually as more sophisticated typological methods came into use, methods that named well-defined

artifact types according to their shape, dimensions, and assumed use, such as the Acheulian hand ax and the Mousterian sidescraper, named after the village of Le Moustier, France (see [Figure 11.7a](#)). This approach, like the type-fossil concept before it, led to searches for perfect, “typical” artifacts. Many functional labels, such as “projectile point” remain in use in modern stone-tool studies but they are not considered anything more than a generalized description of the form of an artifact. Functional analyses of this type have achieved great refinement in western Europe, where many varieties of Stone Age tools are to be found (Bordaz, 1970). As with other artifact forms, recent classifications have a sophisticated concern with analyses based on attributes chosen for their ability to throw light on manufacturing technology or function.

In recent years, the focus of lithic analysis has shifted dramatically from a preoccupation with finished tools to a broader concern with prehistoric lithic technology in a context of human behavior. Modern studies of stone technology rely on a combination of several approaches that focus as much on the processes of manufacture of artifacts as they do on the artifacts themselves.

Debitage Analysis The making of any stone artifact is the result of a **reduction sequence**, a series of steps that begins with the selection of a core of fine-grained rock and ends with the completion of a finished artifact. Reconstructing these reduction sequences is one way in which archaeologists achieve an understanding of artifact-manufacturing processes in prehistory.

Ancient stone-tool manufacture can be reconstructed in several ways, for the clues lie in abandoned cores, in flake scars, in striking platforms, in the dimensions of flakes and blades, and even in the obvious and not-so-obvious mistakes made by ancient artisans. For example, a blow struck at the wrong point on a carefully prepared core can shatter it in distinctive ways easily recognized by someone familiar with lithic technology. Most steps in stone-tool manufacture can be recognized by studying finished artifacts, cores, and above all, the debris, often called **debitage**, left behind by the stoneworker. By close examination ofdebitage, an expert lithic technologist can separate primary flakes, flakes resulting from the rough blocking out of the core,

from the finer flakes that were removed as the artisan prepared the striking platform on the top or sides of the core. Then there are the flakes that all this preparatory work was aimed at—the artifact blanks struck from the core. Finally, there are the fine retouching flakes that turn the blank into the finished projectile point, scraper, or whatever other implement was needed.

Lithic Experimentation Archaeologists have experimented with the making of stone tools since the mid-nineteenth century. Today many archaeological laboratories ring with the sound of people trying to make stone tools and replicate ancient technology—and cutting their fingers in the process. Experimental work began with general attempts to compare the methods of making stone tools of living peoples, such as the Australian Aborigines, with those of prehistoric cultures. Modern experimenters have drawn on both experimentation and ethnographic observation to work out prehistoric techniques. Recent research has focused on reconstructing reduction sequences and also on locating and studying quarry sites; both approaches attempt to reconstruct prehistoric trade in obsidian and other rocks that can be traced back to their source (see [Chapter 16](#)) and to understand better the relationships between human behavior and lithic technology.

There is another side to experimental lithic technology as well. Obsidian flake and blade edges are so sharp that they are widely used by modern eye surgeons, on the grounds that such cutting tools are superior to modern steel!

Petrological Analyses Petrological analyses have been applied with great success to the rocks from which stone tools are made, especially ground stone axes in Europe. Petrology is the study of rocks (Greek *petros*, “stone”). A thin section of the ax is prepared and examined under a microscope. The minerals in the rock can then be identified and compared with samples from quarry sites (Ericson and Purdy, 1984). British archaeologists have had remarkable success with this approach and have identified more than 20 sources of ax-blade stone (Cooney, 2015). Spectrographic analysis of distinctive trace elements in obsidian has yielded remarkable results in southwestern Asia and Mesoamerica, where this distinctive volcanic rock was traded widely from several

quarry centers (Torrence, 1986). (See [Chapter 16](#).)

Refitting Watch someone making stone tools, and you will find that the person is sitting in the middle of a pile of ever-accumulating debris—chips, flakes, abandoned cores, and discarded hammerstones. Ancient stoneworkers produced the same sort of debris—hundreds, if not thousands, of small waste fragments, by-products of toolmaking that are buried on archaeological sites of all ages. Vital information on prehistoric lithic technology comes from careful excavation of all the debitage from a place where a prehistoric artisan worked, and then trying to fit the pieces together one by one, to reconstruct the procedures used—a process called **refitting**.

Refitting taxes the patience of even the most even-tempered archaeologist but can yield remarkable results. At the 9,000-year-old Meer II site in northern Belgium, Daniel Cahen and Lawrence Keeley (1980) combined edge-wear analysis with refitting to reconstruct a fascinating scenario. They used the evidence from three borers that were turned counterclockwise to show that a right-handed artisan walked away from the settlement and made some tools, using some prepared blanks and cores he brought with him. Later, a left-handed artisan came and sat next to him, bringing a previously prepared core, from which he proceeded to strike some blanks that he turned into tools. Reconstruction in this sort of fine detail is often impossible, but it has the advantage that the artifact pattern revealed in the archaeological record can be interpreted

All this technological artistry stemmed from a simple blade technology that, like the Swiss Army knife, allowed endless innovation and ingenuity. The same technologies of burins and grooved antlers persisted long after the Ice Age and were a staple of hunter-gatherer societies in Europe as recently as 7000 B.C. By this time, stone technology was so refined that a stoneworker relied on much smaller cores to produce microblades that were snapped, then often mounted in wooden handles to serve as arrow barbs and for other purposes.

Sometimes, lithic specialists trace the movement of individual fragments or cores horizontally across a site, a process that requires even more patience than simple refitting. This procedure is of great value in reconstructing the functions of different locations in, say, a

rock-shelter site, where a stoneworker might make tools in one place, then carry a core to a nearby hearth and fashion another blade for a quite different process. This approach works well on Folsom Paleo-Indian sites on the Great Plains, where individual flakes have been refitted to their cores after having been excavated from locations as much as 12 feet (3.6 m) away.

Use-Wear Analysis Use-wear analysis involves both microscopic examination of artifact working edges and actual experiments using stone tools, in an effort to interpret telltale scratches and edge luster resulting from their use (Hayden, 1979; Keeley, 1980). Many researchers have experimented with both low- and high-power magnification and are now able to distinguish with considerable confidence among the wear polishes associated with different materials such as wood, bone, and hide (Vaughan, 1985). The approach is now reliable enough to allow one to state whether a tool was used to slice wood, cut up vegetables, or strip meat from bones, but relatively few archaeologists are trained in using the microscopes and photographic techniques required for analyzing wear. Cahen and Keeley's study (1980) of stone tools from the Meer II site in Belgium showed that two people had used the tools they made to bore and grave fragments of bone. In instances like this, tool-wear analysis offers exciting opportunities for studying the behavior of individual stoneworkers thousands of years ago. There are many examples of distinctive microwear patterns, among them polishes that can be identified with high-powered microscopes. One instance is the flint sickle blade used for harvesting wild or domesticated grasses, which often shows a gloss caused by the silica in the grass stems.

Doing Archaeology Blade Technology—The Swiss Army Knife of the Late Ice Age

The bright red Swiss Army knife is a common artifact in the pockets of travelers throughout the world. Not limited to merely cutting and opening bottles, the most elaborate forms of the tool have scissors, tweezers, screwdrivers, nail file, toothpick, and corkscrew. One of us (Brian) has eaten meals with this remarkable knife, extracted thorns, spliced ropes at sea, even sawn his way through animal fibers. All of this is possible because the Swiss Army knife is basically a strong-

hinged chassis with all manner of implements attached to it.

Late Ice Age blade technology had its own Swiss Army knife in the blade core, the carefully shaped nodule of fine-grained rock from which a stoneworker would strike off numerous parallel-sided, thin blades (see [Figure 11.8](#)). Carry around the core like a pocket knife and you could fabricate a convenient stone tool any time you wished. The repertoire of late Ice Age blade artifacts included a broad array of blunt-backed knives for spears, cutting tools, woodworking implements such as simple spokeshaves, and most important of all, the **burin**, a blade with a chisel facet on the end, which opened up another range of artifact possibilities.

The burin could groove through the thick outer surface of fresh deer and reindeer antler, allowing late Ice Age people to extract long, thin strips of antler, which they turned into barbed fish and hunting spear points (see [Figure 11.8](#)). Larger antler fragments were used as spear-throwers in order to propel spears much longer distances. Many other artifacts were used for specialized purposes. Most important of all, fine burins and borers enabled men and women to fashion the first perforated needles, needed for making the tailored, layered clothing that was essential for survival in long, subzero winters.

[Figure 11.8](#) The “Swiss Army knife” technology of the European late Ice Age.

Marvin Kay of the University of Arkansas has used three-dimensional Nomarski optics, which enables him to examine artifact surfaces with different colors of polarized light, to focus on polishes and on microscopic striations that result not only from hafting projectile points but also from the impact on the head when it strikes an animal. Nomarski optics also distinguishes other uses, such as butchery and woodworking. Kay compares the use wear on prehistoric artifacts with different use patterns resulting from modern experiments with artifact replicas on elephants and other animals. He has found, for example, that Clovis points from North America display minute scratches near the base that result when the head absorbs the shock of impact during the hunt. Not only that, but there are clear signs that many of them were used, then reshaped and used again, often serving as knives after their usefulness as points was over. Kay’s methodology is so sophisticated that he can even detect planing effects on tough stone like

quartzite, the planing resulting from use of the artifact for butchery. This research will allow archaeologists to develop histories of individual artifacts as part of a larger-scale analysis of activities on archaeological sites (Kay, 1996).

The important thing about lithic analysis is not just the study of the implements themselves; it is the understanding of what the implements mean in terms of human behavior. And the new multifaceted approaches to lithic analysis offer a real chance that methods such as edge-wear analysis will provide definitive ways of classifying stone tools in terms of their original functions.

Clay (Ceramics)

Objects made of clay are among the most imperishable of all archaeological finds, but pottery is a relatively recent innovation. From the very earliest times, people used animal skins, bark trays, ostrich eggshells, and wild gourds for carrying loads beyond the immediate surroundings of their settlements. Such informal vessels were ideal for hunter-gatherers, who were constantly on the move. Pottery appeared before 6000 B.C. at such early agricultural settlements in southwestern Asia as Çatalhöyük, Jarmo, and Jericho. In contrast, in southern China, pottery was made by hunter-gatherers at least 16,000 years ago, and at a similar time in Japan (see the People of the Past box). The inhabitants of the Tehuacán Valley in highland Mexico began cultivating crops before the first pottery appeared in North America, in about 2000 B.C.

The invention of pottery seems to have coincided with the beginning of more lasting settlement. Fired-clay receptacles have the advantage of being both durable and long lived. We can assume that the first clay vessels were used for domestic purposes: for cooking, carrying water, and storing food. They soon assumed more specialized roles in salt making, in ceremonial activities, and as oil lamps and burial urns. Broken ceramic vessels are among the most common archaeological finds. Their shape, style, and form have provided the foundations for thousands of archaeological analyses (Olin and Franklin, 1982; Orton et al., 1993).

Pottery Technology

Modern industrial potters turn out dinnerware pieces by the millions, using mass-production methods and automated technology. Prehistoric artisans created each of their pieces individually, using the simplest of technology but attaining astonishing skill in shaping and adorning their vessels.

The clay used in making pots was invariably selected with the utmost care; often, it was even traded over considerable distances. The consistency of the clay is critical; it is pounded meticulously and mixed with water to make it entirely even in texture. By careful kneading, the potter removes the air bubbles and makes the clay as plastic as possible, allowing it to be molded into shape as the pot is built up. When the clay is fired, it loses its water content and can crack, so the potter adds a *temper* to the clay, a substance that helps reduce shrinkage and cracking. Although some pot clays contain a suitable temper in their natural state, pot makers commonly added many other materials such as fine sand, powdered shell, or even mica as artificial temper.

People of the Past The Jomon of Japan

The Japanese archipelago boasts many firsts, including the production of some of the oldest pottery in the world. The oldest securely dated examples, from a cave in the northwest coast of modern-day Kyushu, date back to 12,700 B.C. , though some argue that other examples could go back to the fourteenth millennium B.C. , if not before.

The Jomon must be one of the most unusual cultures in the world, since in many ways it defies usual archaeological categorization (see [Chapter 2](#)). Despite the presence of ceramics, their culture has few signs of domesticated animals and plants, a key criterion for the Neolithic. Though they may have practiced a kind of rudimentary agriculture (there is evidence that the Jomon cultivated gourds, beans, and perhaps chestnuts and millet), they were fishers, gatherers and hunters. So were they Mesolithic? No: Very early on, around 14,000 years ago, the Jomon began to settle down and soon worked out a highly complex system of food collection and storage, and constructing large villages of well-built pit houses and longhouses. By around 4000 to 2500 B.C. they were also building structures that might be comparable to the European monuments that were aligned on the position of the sun. So in these respects, they sound very Neolithic. Or could they even be Bronze Age

given their degree of social organization? Well maybe, apart from the fact that they did not use bronze. It was not until around 300 B.C. that the Jomon culture was replaced by the metal using and rice farming Yayoi culture, from an area currently known as the Korean Peninsula. Clearly, the traditional (i.e., European) categorizations just don't work, and the Jomon is an excellent example of how we should avoid trying to squash everyone into a "one trajectory fits all" model.

Figure 11.9 An exquisite Jomon flame-style deep bowl (2500–1500 B.C.).

Source: Courtesy of age fotostock/Alamy Stock Photo.

As for the ceramics themselves, they display a long and interesting development over the past 14,000 years plus. Within this time, four main pottery phases can be identified. In Stage One, (circa 13,700–9200 B.C.) the first potters seem to reproduce everyday objects in clay: basketry, wooden objects, and bags made of skin all get modeled in clay. Two popular styles were bullet-shaped deep pots and square pots with round bases. Experimental archaeology (together with advice from practicing potters) suggests that it is difficult to make square pots with flat bases with good balance. Again, this hints that the potters were copying vessels made of wood or basketry.

However, in Stage Two (circa 9200–5300 B.C.), the potters started to understand and work with clay, thus they favored round-based deep pots—a shape that works better with clay. Pots also began to be decorated. Again, experimental archaeology suggests that a lot of the designs were probably made by carefully twisting and tightening lengths of cord so that they left impressions on the leather-hard clay before being fired. This decorative technique gives the period its name *Jomon*—translated as “cord marking.” Soon, the potters began decorating in earnest—patterns were often made by rolling carved sticks across the surface of the pots or by pressing shells into the clay before firing. These techniques gave rise to the increasingly complex designs of Stage Three (circa 5300–3500 B.C.).

In the earlier stages, pots had largely been used for cooking food, but now new vessel shapes for other purposes begin to appear, including shallow dishes for serving food and storage jars. This diversification was accompanied by new motifs. In the final Stage Four (circa 3500–900

B.C.), Jomon pottery reaches its zenith and was also used for new purposes, such as for burial urns or pottery lamps, and its enigmatic clay figurines, known as *dogu*, become highly stylized. Artistically, their vessels can be very elaborate (Figure 11.9). Some motifs—such as curvy S shapes or dagger shapes—are so standardized that some archaeologists wonder whether they were something of a communication system.

This then was an extraordinarily long-lived culture—or possibly even series of related cultures (as some scholars currently suggest) that possessed an extremely interesting ceramic tradition (or traditions) making the Jomon of supreme interest when considering the technological developments of the past (Kobayashi and Kaner, 2004; Bailey et al., 2010).

Pot making (ceramics) is a highly skilled art, with the following three major methods:

1. **Coil.** The vessel is built up with long coils or wedges of clay that are shaped and joined together with a mixture of clay and water (see Figure 11.10). Sometimes the pot is built up from a lump of clay. Hand methods were common wherever pot making was a part-time activity satisfying local needs.
2. **Mold.** The vessel is made from a lump of clay that is either pressed into a concave mold or placed over the top of a convex shape. Molding techniques were used to make large numbers of vessels of the same size and shape, as well as figurines, fishing net weights, and spindle whorls. Sometimes, several molds were used to make the different parts of a vessel.
3. **Potter's Wheel.** Wheel-made pots came into wide use after the invention of the potter's wheel in Mesopotamia about 5,000 years ago. The vessel is formed from a lump of clay rotating on a platform turned by the potter's hands or feet. The wheel method has the advantage of speed and standardization and was used to mass-produce thousands of similar vessels, such as the bright red Roman Samian ware (Shepard, 1971). Wheel-made pots can sometimes be identified by the parallel rotation marks on their interior surface.

Figure 11.10 Hopi woman making pottery with clay coils, Oraibi Pueblo, Arizona, 1903.

Source: Courtesy of Library of Congress/Corbis/VCG via Getty Images.

Surface finishes provided a pleasing appearance and also improved the durability of the vessel in day-to-day use. Exterior burnishing and glazing made vessels watertight or nearly so. The potter smoothed the exterior surface of the pot with wet hands. Often, a wet clay solution, known as a *slip*, was applied to the smooth surface. Brightly colored slips were often used and formed painted decorations on the vessel (see Figure 11.11). In later times, glazes came into use in some areas. A *glaze* is a form of slip that turns to a glass-like finish during high-temperature firing. When a slip was not applied, the vessel was allowed to dry slowly until the external surface was almost like leather in texture. Many utilitarian vessels were decorated with incised or stamped decorations, using shells, combs, stamps, and other tools. Some ceremonial pots were even modeled into human effigies or were given decorations imitating the cords used to suspend the pot from the roof.

Figure 11.11 A painted Zuni pot, circa 1880. Zuni Pueblo, New Mexico.

Source: Courtesy of National Museum of the American Indian.

The firing of clay objects requires careful judgment on the part of the potter. Most early pottery was fired over open hearths. The vessels were covered with fast-burning wood, whose ash would fall around the vessels and bake them evenly over a few hours. Far higher temperatures were attained in special ovens, known as **kilns**, which would not only bake the clay and remove its plasticity but would also dissolve carbons and iron compounds. Kilns were used to fire vessels at high temperatures and also for glazing, when two firings were needed. Once fired, the pots were allowed to cool slowly, and small cracks were repaired before they were ready for use.

The making of clay vessels was circumscribed by all manner of social and other variables (Arnold, 1991). Archaeological literature is rich in descriptions of pot-making techniques among people all over the world. Unfortunately, however, few of these studies go beyond technology and processes of manufacture. They may tell us something about the

division of labor in making pots, but they reveal little about the potters' status in their own society, their artistic attitudes, or changing ceramic fashions. In many societies, pottery has a well-defined economic role, and the training of potters is long and elaborate. The analysis of ceramics in archaeology must, however, depend on an understanding of the cultural influences that lie behind the variations in pottery in the archaeological record.

Ceramic Analysis

An enormous expenditure of archaeological energy has gone into **ceramic analysis**, and a sophisticated literature covers the common analytical methods.

Analogy and Experiment Controlled experiments to replicate prehistoric ceramic technology have been undertaken to acquire data on firing temperatures, properties of tempers, and glazing techniques (Shepard, 1971). Ethnographic analogy has been a fruitful source of basic information on potters and their techniques (Kramer, 1997), and the direct historical approach traces modern pottery styles back to the prehistoric past.

Figure 11.12 A Moche portrait bottle from Peru.

Source: Courtesy of age fotostock/Alamy Stock Photo.

Form Analysis and Stylistic Analysis Two features of ancient pottery are immediately obvious when we examine a collection of vessels: shape and decoration. Generations of archaeologists have used ethnographic analogy to assign specific functions to different vessel forms. Bowls are commonly used for cooking and eating but globular vessels are most suitable for storing liquids. Sometimes, associations of clay vessels and other artifacts, such as cooking utensils, leave no doubt as to their function. But such instances are rare, and archaeologists usually must rely on analysis of the vessel's form to infer its function.

Form analysis depends on the common assumption that the shape of a vessel directly reflects its function. This assumption, which is based on ethnographic analogies, can be dangerous, for many intangibles affect the function of pottery. Intangibles include the properties of the clay

used, the technological devices available, and perhaps most important, the cultural values that constrain not only the technology but also the uses and fashions of the vessels. Changes in vessel form can sometimes reflect a change in economic activities, but the economic evidence must be complete before such conclusions can be drawn. The functional distinction between utilitarian vessels (see [Figure 10.9](#) on page 195) and ceremonial vessels ([Figure 11.12](#)) is one of the most evident, but it must be supported by vessel form and by direct association with other artifacts.

Form analysis is based on careful classification of clusters of different vessel shapes. These shapes can be derived from complete vessels or from potsherds that preserve the rim and shoulder profiles of the vessel. It is possible to reconstruct the pot form from these pieces by projecting measurements of diameter and vessel height. Such analyses produce broad categories of vessel form that are capable of considerable refinement.

Stylistic analysis is much more commonly used, for it concentrates not on the form and function of the vessel but on the decorative styles used by the potters. These are assumed to be independent of functional considerations and so reflect more accurately the cultural choices made by the makers. In areas such as the American Southwest, pottery styles have been used to trace cultural variations over thousands of years.

Even a cursory glance at pottery reports from different parts of the world will show you that archaeologists have used dozens of different stylistic classifications to study their potsherds. Only in recent years have people tried to standardize stylistic classifications, using clusters of easily recognized attributes to produce hierarchies of types, varieties, and modes. With this approach, small numbers of distinctive attributes from different pottery assemblages are recorded. These attributes commonly appear in associated sets of features that provide the basis for erecting types and varieties of pottery styles, which are assumed to represent the social system behind the pots studied. For instance, Classical Attic and Corinthian pottery from Greece reflect standardized styles that can be dated accurately. Although a *variety* may represent only the activities of one family of potters, a *type* can represent the work of several villages or an entire community. Thus, goes the argument, standardized pottery types reflect a fairly rigid social system

that prescribes what pottery styles are used, but less formal designs are characteristic of a less restrictive society. However, can one really assume that pottery styles reflect social behavior? The answer must await the day when many more standardized typologies from different areas of the world are available.

Technological Analysis The more elaborate, computer-generated classifications of today reveal that many of the archaeologist's classificatory cornerstones, such as pottery temper, are, in fact, subject to complex behavioral and environmental factors rather than the simple barometers of human behavior they were once thought to be. For example, Marian Saffer found that classifications developed for pottery from the Georgia coast in the southeastern United States were based on simple criteria, among them tempers of sand, grit, and ground-up potsherds. There appeared to have been little variation in the style and decoration in Georgia coastal pottery for 2,000 years. Therefore, archaeologists used variations in temper as criteria for distinguishing new cultures and phases. Saffer used clay samples from the islands and the mainland, as well as many decorative and stylistic attributes, together with a sophisticated computer analysis, to show that variations in temper could be correlated with the qualities of different potting clays. Thus, variations in temper are due not only to cultural factors but also to environmental conditions (Rice, 2015).

Technological analysis of pottery focuses on the fabric and paste in potting clays and relates ceramic vessels to locally available resources. It also provides useful, statistically based yardsticks for interpreting variability between different pottery forms and for developing much more sophisticated pottery classifications. Furthermore, the current interest in regional studies of prehistoric cultures and in trade and exchange encourages the analysis of pottery clays as a means of tracing centers of ceramic manufacture. Throughout later prehistory, clay vessels were major trade commodities, not only for their own qualities but also because they were convenient receptacles for such products as olive oil, wine, or salt.

Tell el-Amarna in Egypt was founded by the heretic Egyptian king Akhenaten in 1348 B.C. and was occupied only for only 17 years, abandoned shortly after his death (see the Amarna Box in [Chapter 9](#),

page 176) fifteen years later. It is famous for its fine artworks, for the immortal head of Queen Nefertiti, and for its diplomatic correspondence. Egyptologist Flinders Petrie found more than 1,300 Mycenaean potsherds in rubbish dumps from el-Amarna's palace and nearby noble residences. Most of them were from containers used to carry imported, scented oils, which were traded widely from the Aegean across the eastern Mediterranean at the time. By using neutron-activation analysis of 37 elements in the clays used to make these vessels and comparing them with samples taken from Mycenaean vessels discovered in Greece, German scientists have pinpointed their original place of production as a major pottery workshop in the Mycenae-Berati region of the eastern Peloponnese in mainland Greece—a remarkable piece of archaeological detective work now being expanded with computer databases (Mommsen et al., 1992).

Numerous other procedures yield valuable information on ancient ceramics, including X-ray diffraction studies and ceramic petrology. These approaches can be used in combination to study what can be called **ceramic ecology**, the interaction of resources, local knowledge, and style that ultimately leads to a finished clay vessel. For instance, Mississippian pottery, manufactured in the southern and southeastern United States between A.D. 800 and 1500, was fired to a temperature between 1,472°F (800°C) and 1,652°F (900°C). The Mississippians used crushed shell to temper their pots, so their vessels should not have vitrified at these temperatures. But they did, and scanning electron microscope photographs reveal that the potters may have added salt to their raw clay, perhaps even tasting the clay during manufacture to see if it was correctly mixed. Mississippian settlement was concentrated in valley bottoms, where the potters used clay heavy in montmorillonite, adding crushed shell so that they could work the clay more easily. This technique created another problem, that of poor firing. So the potters added salt to improve the firing qualities. However, salt was available in relatively few locations, so a complex trading system in this newly vital commodity developed.

Technological analyses of pottery offer useful ways to amplify manufacturing data obtained from archaeological sources and ethnographic analogy (Arnold, 1985). The sediments found inside ancient pots can be examined spectrographically, and sometimes

identified (McGovern, 2010) Evidence for quite sophisticated wine making was found from an Armenian cave and dates to about 4100 B.C. The finds include grape seeds, a press, and a drinking cup with chemical residues of wine. Currently, the earliest traces of wine making date to about 6000 B.C. in Georgia, Central Asia.

Metals and Metallurgy

The study of metallurgy and metals found in archaeological sites is limited both by the state of preservation and by our knowledge of prehistoric metallurgy as a whole (Muhly and Wertime, 1980; Tylecote, 1992). Preservation of metal tools in archaeological horizons depends entirely on the soil's acidity. In some circumstances, iron tools are preserved perfectly and can be studied in great detail; in other cases, soil acids have reduced the iron to a rusty mass that is almost entirely useless. Copper, silver, and gold normally survive somewhat better.

Metals first became familiar to people in the form of rocks in their environment. Properties of metal-bearing rocks—color, luster, and weight—made them attractive for use in the natural state. Eventually, people realized that heat made such stones as flint and chert easier to work. When this knowledge was applied to metallic rocks, stoneworkers discovered that native copper and other metals could be formed into tools by a sequence of hammering and heating. Of the seventy or so metallic elements on the earth, only eight—iron, copper, arsenic, tin, silver, gold, lead, and mercury—were worked before the eighteenth century A.D. Properties of these metals that were important to ancient metalworkers were, among others, color, luster, reflecting abilities (for mirrors), acoustic quality, ease of casting and welding, and degrees of hardness, strength, and malleability. Metal that was easily recycled had obvious advantages (Craddock, 1995).

We know much about ancient metallurgy because prehistoric artifacts preserve traces of their thermal and mechanical history in their metallic microstructure. This structure can be studied under an optical microscope. Each grain of the metal is a crystal that forms as the metal solidifies. The shape and size of the grains can reveal whether alloys were used and indicate the cooling conditions and the type of mold used. At first, prehistoric metallurgists used “pure” metals, which could

be worked easily but produced only soft tools. Then they discovered how to alloy each of these metals with a second one to produce stronger, harder objects with lower melting points.

The basic data for studying prehistoric alloys come from *phase diagrams*, which relate temperature and alloy composition, showing the relative solubility of metals when combined with other metals. Phase diagrams are developed under controlled conditions in a laboratory and tend to reflect ideal conditions. By examining the object under an optical microscope, researchers can often spot differences in chemical composition, such as the cored, treelike structure that is characteristic of cast copper-tin alloys. Metals contain insoluble particles that can give clues to the smelting procedures and types of ores used. An energy-dispersive X-ray spectrometer and a scanning electron microscope are used to identify the particles. This impressive battery of analytical techniques has enabled archaeologists to study how 6,000 years of experimentation took humanity from simple manipulation of rocks to the production of steel in about 1000 B.C. The record of these millennia is read in the lenses of the microscope and reveals the triumphs and frustrations of the ancient smith.

Copper

The earliest metal tools were made by cold-hammering copper into simple artifacts. Such objects were fairly common in southwestern Asian villages by 6000 B.C. . Eventually, some people began to melt the copper. They may have achieved sufficiently high temperatures with established methods used to fire pottery in clay kilns. The copper was usually melted or smelted into shapes and ingots within the furnace hearth itself. Copper metallurgy was widespread by about 4000 B.C. European smiths were working copper in the Balkans as early as 3500 B.C. In contrast to high-quality stone and iron, copper ores are rare and concentrated in well-defined regions. The metal was normally, but not invariably, alloyed with tin, which is even rarer. In the New World, copper working was well developed among the Aztecs and Inca. The Archaic peoples of Lake Superior exploited the native deposits of copper ore on the southern shores of the lake, and the metal was widely traded and cold-hammered into artifacts from Archaic to Woodland times

(Figure 11.13).

Figure 11.13 This Mississippian copper head appears to have been cut out of a larger plate with the feather then riveted on. From the Craig Mound at Spiro, Oklahoma. Length: 9.4 in (24 cm).

Source: Courtesy of the National Museum of the American Indian, Smithsonian Institution, 20/0699.

Bronze

The real explosion—it was nothing less—in copper metallurgy took place midway through the fourth millennium B.C. , when southwestern Asian smiths discovered that they could improve the properties of copper by alloying it with a second metal, such as arsenic, lead, or tin. Perhaps the first alloys came about when smiths tried to produce different colors and textures in ornaments. But they soon realized the advantages of tin, zinc, and other alloys that led to stronger, harder, and more easily worked artifacts. There is reason to believe that they experimented with the proportions of tin for some time, but most early bronzes contain about 5 to 10 percent tin (10 percent is the optimum for hardness). An extraordinary development in metallurgical technology occurred during the third millennium B.C. , perhaps in part resulting from the evolution of writing and the expansion of trade in raw materials. By 2500 B.C. , practically every type of metallurgical phenomenon except hardening of steel was known and used regularly. The use of tin alloying may have stimulated much trading activity, for the metal is relatively rare, especially in southwestern Asia. Bronze-working was developed to a high pitch in northern China after 2000 B.C.

Gold

Gold-decked burials fascinate many people, but in fact they are rare finds in archaeological excavations. Gold did, however, have a vital part in prestige and ornamentation in many ancient societies. Thus, Tutankhamun is sometimes described as the “Golden Pharaoh” because his grave was rich in spectacular gold finds (Reeves, 2007). The burials of Moche lords of A.D. 400 under an adobe platform at Sipán, on the northern coast of Peru, revealed the remarkable wealth of this desert

civilization. One shroud-wrapped warrior-priest wore a pair of gold eyes, a gold nose, and a gold chin-and-neck visor; his head was lying on a gold, saucer-like headrest (see [Figure 6.4](#) on page 95). Hundreds of minute gold and turquoise beads adorned the lord of Sipán, who wore 16 gold disks as large as silver dollars on his chest. One of the warriors with a movable club wore gold-and-feather headdresses and intricate ear ornaments, (Alva and Donnan, 1993). The later Sicán and Chimú peoples of coastal Peru were master goldsmiths of pre-Columbian Latin America (see the Site Box on p. 214). The Aztecs and the Inca also were talented goldsmiths whose magnificent products were shipped off to Europe and melted down for royal treasuries in the sixteenth century (Hosler, 1995).

Gold rarely forms compounds in its natural state. It was collected in its pure form or in grains gathered by crushing quartz and concentrating the fine gold by washing. The melting point of gold is about the same as that of copper; therefore, no elaborate technology was needed. Gold is easily hammered into thin sheets without **annealing**—heating and cooling of metal to make it less brittle. Prehistoric smiths frequently used such sheets to sheath wooden objects such as statuettes. They also cast gold, used appliqué techniques, and alloyed it with silver and other ores. Gold was worked in southwestern Asia almost as early as copper, and it was soon associated with royal prestige. The metal was widely traded in dust, ornament, and bead form in many parts of the Americas and the Old World.

Iron

Bronze Age smiths certainly knew about iron. It was a curiosity, of little apparent use. They knew where to find the ore and how to fashion iron objects by hammering and heating. But the crucial process in iron production is *carburization*, in which iron is converted into steel. The result is a much harder object, far tougher than bronze tools. An iron object is carburized by heating it in close contact with charcoal for a considerable period of time. The solubility of carbon in iron is very low at room temperature but increases dramatically at temperatures above 1,670°F (910°C), which could easily be achieved with charcoal and a good Bronze Age bellows. It was this technological development that

led to the widespread adoption of iron technologies in the eastern Mediterranean area at least by 1000 B.C. (Muhly and Wertime, 1980).

Iron tools are found occasionally in some sites as early as 3000 B.C. , but widespread smelting does not seem to have begun until the second millennium B.C. Use of iron was sporadic at first, for objects made of the metal were still curiosities. Iron tools were not common until around 1200 B.C. , when the first iron weapons appeared in eastern Mediterranean tombs. The new metal was slow to catch on, partly because of the difficulty of smelting it. Its widespread adoption may have coincided with a period of disruption in eastern Mediterranean trade routes as a result of the collapse of several major kingdoms, among them that of the Hittites, after 1200 B.C. Deprived of tin, the smiths turned to the much more readily available substitute—iron. It was soon in use even for utilitarian tools and was first established on a large scale in continental Europe in the seventh century B.C. by Hallstatt peoples (Collis, 1997).

In earlier times, iron had a comparatively limited economic role, most artifacts being slavish copies of bronze tools before the metal's full potential was realized. Weapons, such as swords and spears were the first artifacts to be modified to make use of the new material. Specialized ironworking tools, such as tongs, as well as woodworking artifacts, began to be used as soon as the qualities of iron were recognized.

Iron ore is much more abundant in the natural state than copper ore. It is readily obtainable from surface outcrops and bog deposits. Once its potential was realized, it became much more widely used, and stone and bronze were relegated to subsidiary, often ornamental, uses.

The influence of iron was immense, for it made available abundant supplies of tough cutting edges for agriculture. With iron tools, clearing forests became easier, and people achieved even greater mastery over their environment. Ironworking profoundly influenced the development of literate civilizations. Some peoples, such as the Australian Aborigines and the pre-Columbian Americans, never developed iron metallurgy.

S i T E > The Lord of Sicán at Huaca Loro, Peru <

The Sicán culture flourished along the north coast of Peru from about A.D. 800 to 1100, perpetuating many ancient cultural traditions of its

predecessor, the Moche state. Sicán lords were buried with elaborate grave goods, including many fine copper- and gold-alloy objects. For many years, looters have targeted the burials, many of them associated with the 82-foot (25 m) high Huaca Loro pyramid, Sicán's capital. Archeologist Izumi Shimada began working at the capital in 1978, embarking on a long-term study of settlement pattern and religion in 1990. This work involved a study of tomb contents and construction, also the excavation of a wide range of burials from all segments of Sicán society. Shimada was lucky enough to locate two undisturbed elite tombs at Huaca Loro, which yielded a treasure trove of information on this little known culture (Shimada, 2010).

The Huaca Loro mound lay atop an elite cemetery, probably used by a Middle Sicán dynasty. So far, Shimada has excavated two sepulchers. It took six months to excavate the East Tomb, a 33-foot (10 m) vertical shaft, 10 feet (3 m) square with seven sealed niches. Five skeletons lay in the tomb, as well as 12.2 tons of grave goods, two-thirds of which consisted of copper, gold, and artifacts made of an alloy of gold, silver, and copper. The principal burial was that of a 40- to 50-year-old man, whose body was mummified, painted with red cinnabar paint, and then dressed in full ceremonial regalia. His head was separated from his body, rotated right side up, and then placed in front of his inverted body. His regalia included pectorals made with amber, amethyst, and other semiprecious stones, also a gold ceremonial knife, ear spools, and a golden mask (see [Figure 11.14](#)). A pair of golden gloves and a shin cover lay by the body. A nearby chest contained at least 24 layers of rattles, crowns, headbands, and other gold and alloy ritual objects.

Nearby lay a female adult with her legs flexed wide apart. Another woman sat in front of her with her hands placed close to the first woman's crotch. Shimada believes that the positions of the man and the woman were carefully arranged to symbolize the rebirth of the former.

This Lord of Sicán owned a sumptuous array of gold objects, as well as a huge assemblage of other artifacts that give an impression of his enormous wealth and power—15 bundles of unfinished cast bronze tools, 165 pounds (75 kg) of perforated, semiprecious beads, and about 1,100 pounds (500 kg) of hammered alloy sheet scraps. All of these products would have required thousands of hours to produce. The lord lay with 179 *spondylus* shells and 141 *conus* shells, all imported from

the coast of Ecuador and other areas far to the north. Clearly, Sicán's elite controlled widespread trade routes, in which bronze and produce from irrigation agriculture were major players.

Shimada is now excavating the West Tomb, which lies 82 feet (25 m) to the west. A man of 30 to 40 years of age lay in a central chamber, surrounded by hundreds of artifacts and flanked by two women. About 20 women, mostly between 18 and 22 years old, lay in an antechamber, placed in equal numbers on the north and south sides of the central chamber. Using DNA, ceramic styles, inherited dental characteristics, and general health profiles, Shimada established that the women on the south side were relatively healthy, included two kin groups, and were biologically close not only to one another but also to the principal individual buried in the tomb. They may even have married within their own community. In contrast, those to the north were biologically more heterogeneous and not as healthy. He theorizes that this group represented peoples conquered by the Sicán lords.

A temple stood atop the Huaca Loro mound, its walls covered with murals that display images of the major Sicán god. Shimada believes these may symbolize the deceased lords buried beneath the pyramids, who have now become revered ancestors.

Ground-penetrating radar surveys and text excavations have located at least three unexcavated shaft tombs at three still untested corners of the mound, as well as traces of a large elite cemetery. Long-term research is bound to lead to more spectacular discoveries and a compelling portrait of a powerful and extremely wealthy ancient Andean lineage.

The Sicán lord's grave shows the extraordinary skills of Peruvian metalsmiths centuries before the Spanish Conquest. They were well aware of alloying, had developed ways of joining metal sheets without solder, and made ornaments by cutting out metal and hammering decoration into sheets for a repoussé effect. As did other Andean metalworkers, they used depletion gilding, a technique that used acids to deplete baser metals from the surface of alloyed metal objects, leaving them high in gold concentration and with a golden appearance.

Figure 11.14 Reconstructed gold mask of a lord of Sicán, Peru.

Source: Courtesy of Sergi Reboredo/Alamy Stock Photo.

Metal Technologies

Copper technology began with the cold-hammering of the ore into simple artifacts. Copper smelting may have originated in the accidental melting of some copper ore in a domestic hearth or oven. In smelting, the ore is melted at a high temperature in a small kiln and the molten metal is allowed to trickle down through the charcoal fuel into a vessel at the base of the furnace. The copper is further reduced at a high temperature, then cooled slowly and hammered into shape. This annealing adds strength to the metal. Molten copper was poured into molds and cast into widely varied shapes.

Copper ores were obtained from weathered surface outcrops, but the best material came from subsurface ores, which were mined by expert diggers. Copper mines were in many parts of the Old World and provide a fruitful field for the student of metallurgy to investigate. The most elaborate European workings were in the Tyrol and Salzburg areas, where many oval workings were entered by a shaft from above (Cunliffe, 1997). At Mitterberg, Austria, the miners drove shafts into the hillside with bronze picks and extracted the copper by means of elaborate fire-setting techniques.

Figure 11.15 Excavation in a prehistoric copper mine at Kansanshi, Zambia, Central Africa. The miners followed outcrops of copper ore deep into the ground with narrow shafts, the earth fillings of which yielded both radiocarbon samples and artifacts abandoned by the miners.

Source: Courtesy of Michael S. Bisson.

Many early copper workings have been found in southern Africa, where the miners followed surface lodes under the ground (Bisson, 1977). (See [Figure 11.15](#).) Fortunately, the traditional Central and East African processes of copper smelting have been recorded. The ore was placed in a small furnace with alternating layers of charcoal and was smelted for several hours at high heat maintained with goatskin bellows. After each firing, the furnace was destroyed and the molten copper was dripped onto the top of a sand-filled pot buried under the fire. Bronze technology depended on *alloying*, the mingling of small quantities of such substances as arsenic and tin with copper. With its lower melting point, bronze soon superseded copper for much

metalwork. Some of the most sophisticated bronze work was created by Chinese smiths, who cast elaborate legged cauldrons and smaller vessels with distinctive shapes and decoration in clay molds (see [Figure 11.16](#)).

Ironworking is a much more elaborate technology that requires a melting temperature of at least 2,799°F (1,537°C). (For information about traditional African technology, see Schmidt, 1996a. See also the essays in Norbach, 1997.) Ancient smiths normally used an elaborate furnace filled with alternating layers of charcoal and iron ore that was maintained at a high temperature for many hours with a bellows. A single firing often yielded only a spongy lump of iron, called a bloom, which then had to be forged and hammered into artifacts. It took some time for the metallurgists to learn that they could strengthen working edges by quenching the tool in cold water. This process gave greater strength but it also made the tool brittle. The tempering process, reheating the blade to a temperature below 1,340°F (727°C), restored the strength. Iron technology was so slow in developing that it remained basically unchanged from about 600 B.C. until medieval times.

[Figure 11.16](#) Shang ceremonial bronze vessel from about the twelfth century B.C.

Source: Courtesy of Album/quintlox/AGK Images and Ann Ronan Pictures/Print Collector/Getty Images.

Metal-Artifact Analysis

Typological Analyses In Europe, metal tools have been analyzed for typology since the early nineteenth century. Stylistic features of iron artifacts, bronze brooches, swords, and axes were very sensitive to fashion and to changing trading patterns. As a result, the evolution of bronze pins or iron slashing swords, for example, can be traced across Europe, with small design changes providing both relative dating and occasional insights into the lifeways of the people who used them (Cunliffe, 1997). In many ways, such studies are similar in intent to those carried out with stone implements or potsherds.

Technological Analyses In many respects, technological analyses are more important than the study of finished artifacts. Many of the most

important questions relating to prehistoric metallurgy involve manufacturing techniques. Technological studies start with ethnographic analogies and actual reconstructions of prehistoric metallurgical processes. Chemists study iron and copper slag, as well as residues from excavated furnaces. Microscopic examination of metal structure and ores yields valuable information not only on the metal and its constituents and alloys but also on the methods used to produce the finished tool. The ultimate objective of the technological analyses is to reconstruct the entire process of metal-tool production, from the mining of the ore to the production of the finished artifact.

Bone

Bone as a material for toolmaking probably dates to the very beginnings of human history, but the earliest artifacts apparently consisted of little more than fragments of fractured animal bone used for purposes that could not be fulfilled by wood or stone implements (Leakey, 1973). The earliest standardized bone tools date from later prehistoric times. Splinters of bone were sharpened and used as points in many societies, but bone and antler artifacts were especially favored by the Upper Paleolithic peoples of southwestern France from 30,000 to 12,000 years ago and by postglacial hunter-gatherers in Scandinavia. In both the Old World and the New World, later bone implements were ground and scraped from long bones, hardened in the fire, and polished with beeswax to produce arrowheads, spearpoints, needles, and other artifacts. Bone was also carved and engraved, especially during Upper Paleolithic times in western Europe, as was reindeer antler (Bahn, 2016).

Deer antler was an even more important material than bone for some of the later hunter-gatherers. Fully grown deer antler is particularly suitable for making barbed or simple harpoons and spearpoints. Bone and antler were much used in prehistoric times as harpoons for fishing and conventional hunting. Numerous harpoons are found in Magdalenian sites in western Europe (see [Figure 11.17](#)) and in Eskimo settlements in the Arctic, where they form a valuable index of cultural development, analogous to that of pottery in the American Southwest (Dumond, 1987).

The humble bone or ivory needle may have been a revolutionary artifact in prehistory, for it enabled humans to manufacture layered, tailored clothing. Interestingly, needles (and by extension tailored clothing) may not have been exclusive to *Homo sapiens*. In 2016, archaeologists working in Siberia's Denisova Cave (a site associated with a contemporary but now extinct species of hominin) found the world's earliest-known needle. At 3 inches (76 mm) long, with an eye carved at its top, and made of an unidentified bird bone, it dates back to roughly 50,000 years ago. Although this shows that our species may not have been the only ones to need tailored clothing, we can be certain that well-made, warm garments would have been absolutely necessary for the anatomically modern humans (*H. sapiens*), who moved into the cold periglacial latitudes of the Old World, an event that occurred at least 45,000 years ago (Fagan, 2010).

Bone-Tool Analysis

In the Arctic, where bone and ivory are critical materials, elaborate typological studies have been made of the stylistic and functional changes in such diverse items as harpoons and the winged ivory objects fastened to the butts of harpoons (see [Figure 11.18](#)). Other artifacts include picks made of walrus tusk, snow shovels, and wedges of ivory and bone, as well as drills and domestic utensils. Studying such a range of bone artifacts is complicated by the elaborate and variable engraved designs applied to some, but Henry B. Collins and others have been able to trace the development of the harpoon of the Northern Maritime Eskimo from the elaborate types of the Okvik and Old Bering Sea phases to the simpler forms characteristic of the Punuk phase and the modern Eskimo weapons (Fagan, 2019).

[Figure 11.17](#) Magdalenian antler harpoons from France, about 15,000 years old.

Source: Courtesy of Josse Christophel/Alamy Stock Photo.

Bone technology was quite simple, so technological analyses are rudimentary. The most basic bone technologies involved splitting and flaking bones. Fine points were produced by polishing slivers of bone against grinding surfaces. The Magdalenians used fine lengths of reindeer antler, which they removed from the beam by grooving

through the hard outer core of the antler with stone burins or engraving tools. It is no coincidence that their material culture included a wide range of scraping and graving tools.

Figure 11.18 Winged objects from the Bering Strait region, Alaska, served as counterbalances at the base of harpoon shafts.

Source: Courtesy of Werner Forman Archive/Bridgeman Images.

Wood

Nonhuman primates sometimes use sticks to obtain grubs or for other purposes, so it is logical to assume that, since the earliest times, humans also may have used sticks for various purposes. Wood implements form a major part of many modern hunter-gatherer tool kits; occasional tantalizing glimpses of prehistoric wood artifacts have come down to us where preservation conditions such as extreme aridity or waterlogging have been favorable (see [Chapter 4](#)). The oldest known wooden tools are a series of sophisticated, large wooden throwing spears from a waterlogged site at Schöningen in northern Germany, dating to about 400,000 years ago.

Indeed, wood can often be well-preserved on wet sites. For example, in 1998, a beautifully preserved timber circle, contemporaneous with Stonehenge, was exposed on a Norfolk beach and dubbed “Seahenge” (Pryor, 2001). This, so-far unique, monument comprises a ring of split tree trunks ranged around an upturned, central placed trunk.

Figure 11.19 Seahenge.

Source: Courtesy of CountrySideCollection—Homer Sykes/Alamy Stock Photo.

The decision to excavate was met with great opposition from modern-day Druids and locals, but archaeologists stressed excavation would be the only way to save it for posterity and research. The archaeologists prevailed. Following the controversial excavation, a team then spent a number of years carefully preserving the timbers. This was an arduous task: Ancient waterlogged timbers may retain their form, but they tend to have lost most of their wood content and are thus largely made up of water. Preserving Seahenge, therefore, involved

slowly replacing all the seawater in the timbers with preservatives. Several years later, the remains are now on display at the nearby King's Lynn museum, allowing all to see the ancient monument and speculate on its meaning (Figure 11.19).

At the other end of the spectrum, dry conditions can also allow good preservation of wood. Such sites abound in Egypt. Meanwhile, in western North America, dry sites containing numerous wood artifacts, as well as basketry, have also been found.

Wood-Technology Analysis

The manufacture of wood tools involves such well-understood mechanical processes as cutting, whittling, scraping, planing, carving, and polishing. Fire was often used to harden sharpened spearpoints, and oil and paint imparted a fine sheen and appearance to all kinds of wood artifacts. On the rare occasions when wood artifacts are preserved, important clues to their manufacture can be obtained by closely examining the objects themselves. Unfinished tools are very useful, especially handles and weapons that have been blocked out but not finished (Coles and Coles, 1986). Even more revealing are wood fragments from abandoned buildings, fortifications, and even track walkways. Microscopic analysis of wood fragments and charcoal can provide information about the woods used to build houses, canoes, and other such objects. On very rare occasions, stone projectile heads and axes have been recovered in both waterlogged and dry conditions in which their wooden handles and shafts have survived, together with the thong that were used to bind stone to wood. At Must Farm in eastern England, a sudden fire destroyed a tiny fences settlement of stilt houses. Five huts slid into the mud where the waterlogged deposits preserved bronze-headed spears with their wooden shafts and bark fiber thread finer than human hair (see Chapter 5) (Symonds, 2016b). The Ozette excavations yielded complete house planks and even some wooden boxes that had been assembled by skillful grooving and bending of planks (Kirk, 1974).

In many instances, the only clues to the use of wood come from stone artifacts, such as spokeshaves and scrapers used to work it, or from stone ax blades and other tools that were once mounted in

wooden handles. Only the form of the artifact and occasional ethnographic analogies allow researchers to reconstruct the nature of the perishable mount that once made the artifact an effective tool.

Wood was probably the most important raw material available to our ancestors. The thousands upon thousands of ground stone axes in the archaeological record all once had wooden handles. Wood was used for house building, fortifications, fuel, canoes, and containers. Most skilled woodworking societies used the simplest technology to produce both utilitarian and ceremonial objects. They used fire and the ringing of bark to fell trees, stone wedges to split logs, and shells and stones to scrape spear shafts.

Figure 11.20 Cotton funerary textile from the Paracas Peninsula, Peru, dating to circa 300 B.C.

Source: Courtesy of Museo Arqueologia, Lima, Peru/Bridgeman Images.

Basketry and Textiles

Basket production is one of the oldest crafts (Adovasio, 1979). Basketry includes such items as containers, matting, bags, and a wide range of fiber objects. Textiles are found in many later, dry sites, and they are well preserved along the Peruvian coast (Moseley, 2000).

Some scholars believe that basketry and textiles are among the most sensitive artifacts for the archaeologist to work with—culturally speaking—on the grounds that people lived in much more intimate association with their baskets and textiles than they did with their clay vessels, stone tools, or houses. Furthermore, even small fragments of basketry and textiles display remarkable idiosyncrasies of individual manufacture.

Textile expert Patricia Anawalt spent many years studying pre-Columbian garments depicted on Mexican Indian codices. This research enabled her to work out some of the complicated sumptuary rules that governed military uniforms and other clothing. For example, the length, material, and decoration of Aztec men's cloaks were regulated precisely by the state. Even the type of knot was specified (Anawalt, 1981).

The dry climate of the Peruvian coast has preserved the wardrobes of Paracas nobles buried between 600 and 150 B.C. Paracas rulers wore

mantles, tunics, ponchos, skirts, loincloths, and headpieces. These garments were embroidered with rows of brightly colored anthropomorphic, zoomorphic, and composite figures (see [Figure 11.20](#)). Interpreting the iconographic patterns that appear on these ancient garments tells us something of Paracas religious and social customs (Paul and Turpin, 1986). One of the important functions of a Paracas ruler was to mediate between people and the supernatural forces that influenced and determined life's events. Many of the rulers' garments were adorned with shaman figures, showing that the wearer had a special relationship to the supernatural (Anton, 1988). (For study methods, see King, 1978.)

It is easy for archaeologists to become preoccupied with technology and artifacts, but the potential is great for insights into ancient society and subsistence from such research, provided that the ultimate objective is to study people rather than inanimate objects.

Summary

1. One of the main inorganic materials used by prehistoric peoples was stone, especially hard, homogeneous rock, which fractures according to the conchoidal principle.
2. The basic techniques for manufacturing stone tools were described, starting with the stone-on-stone technique, the cylinder-hammer method, and the prepared cores used to produce blanks for Middle Paleolithic artifacts. Blade technology came into use about 45,000 years ago.
3. Lithic experimentation and ethnoarchaeology have leading roles in the study of stone technologies; edge-wear and petrological studies throw light on the trade in raw materials and the uses to which tools were put.
4. Ceramics (clay objects), which date to the last 10,000 years of prehistory, are a major preoccupation of archaeologists. The process of pottery manufacture, the various methods used, and the surface finishes employed were described.
5. Ceramic analysis proceeds by analogy and experiment, research in which controlled experiments with firing and the properties of

clay have had leading parts. The vessels themselves are studied through form and functional analyses. Many archaeologists prefer to use stylistic analyses. Archaeologists now also use clusters of attributes in attempts to standardize stylistic classifications.

6. Metallurgy is a phenomenon of the past 6,000 years. The basic properties of copper, bronze, gold, and iron were described, as well as some of the cultural contexts in which metallurgy developed. Typological and technological analyses are used to study prehistoric metallurgy.
7. Bone tools are thought to be among the earliest of all artifacts. They are important in some areas, particularly the Arctic, as indicators of typological change. The functional analysis of bone tools is somewhat easier than that of stone tools or ceramics.
8. The manufacture of wood tools involves well-understood mechanical processes, such as cutting and whittling, and these can often be identified even from unfinished artifacts. Stone artifacts and other materials that have been found mounted in wooden handles provide insights into the uses of composite artifacts.
9. Basketry and textiles offer unique opportunities for studying individual idiosyncrasies in the archaeological record; they also provide useful chronological markers.

Further Reading

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- McGovern, Patrick. 2010. *Uncorking the Past: The Quest for Wine, Beer, and Other Alcoholic Beverages*. Berkeley: University of California Press.
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PART V

STUDYING ENVIRONMENTS AND PEOPLE

And I prophesied as I was commanded; and as I prophesied, there was a noise, and behold, a rattling; and the bones came together, bone to its bone. And as I looked, there were sinews on them, and flesh had come upon them, and skin had covered them.

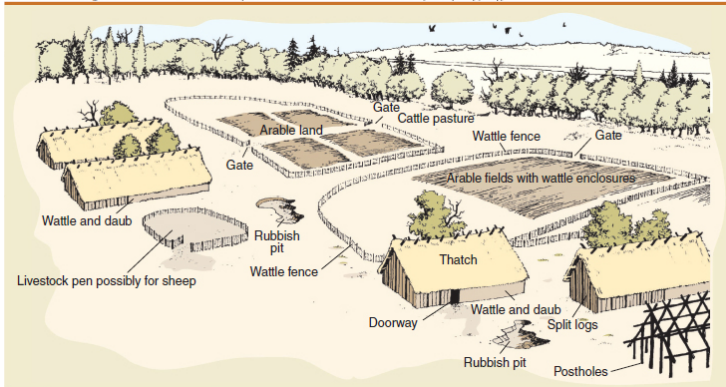
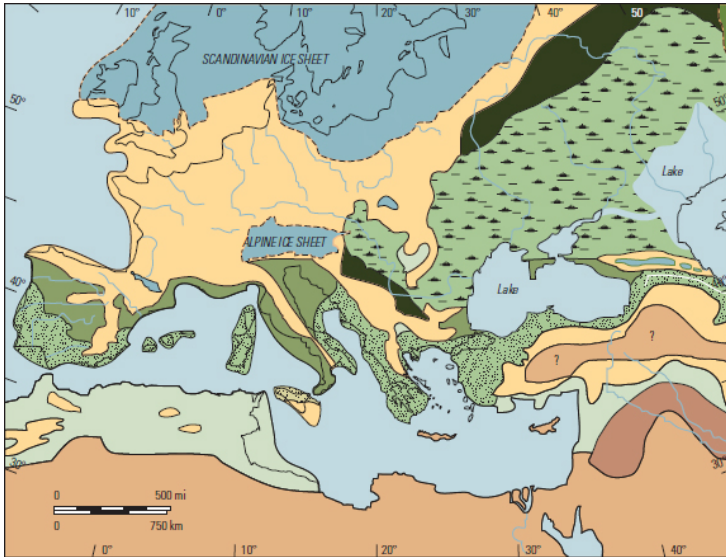
—Ezekiel 37:10

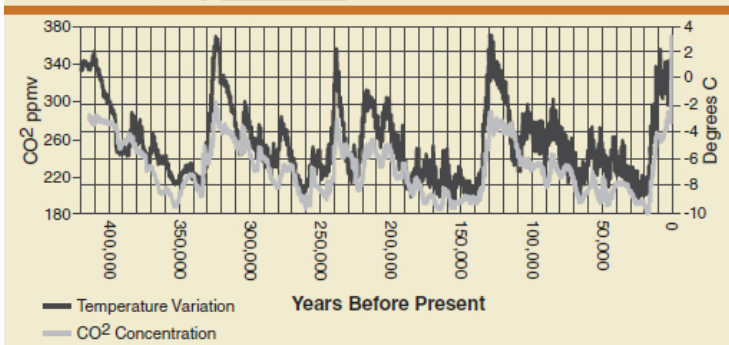
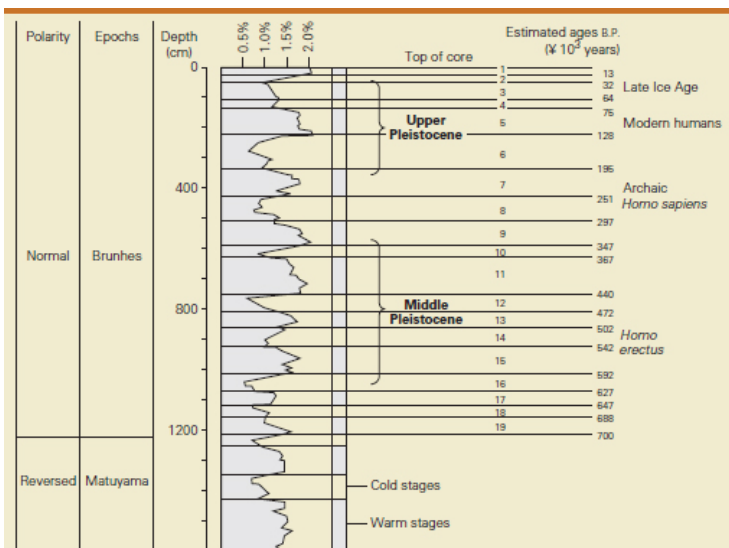
[Part V](#) discusses how archaeologists study the ways in which people have solved the problems of making a living and adapting to their environment. [Chapter 12](#) examines the many ways in which researchers can now reconstruct both long- and short-term climatic and environmental change. [Chapter 13](#) describes the analysis of food remains, animal bones, vegetable foods, and evidence of prehistoric diet. Archaeologists rely very heavily on ethnographic analogies for interpreting prehistoric subsistence and past lifeways. [Chapter 14](#) examines some of the latest work in experimental archaeology and ethnoarchaeology, approaches that involve both controlled experiments and observations in the field. Human settlements changed radically through prehistory. [Chapter 15](#) surveys the ways in which archaeologists study ancient settlement patterns, with special reference to recent research in Mesoamerica. Trade, social organization, and religious beliefs are the topics of [Chapters 16](#) and [17](#), which make the point that much information on these subjects can be obtained through careful research design and meticulous analysis of field data. The study of all facets of ancient lifeways is an essential preliminary to

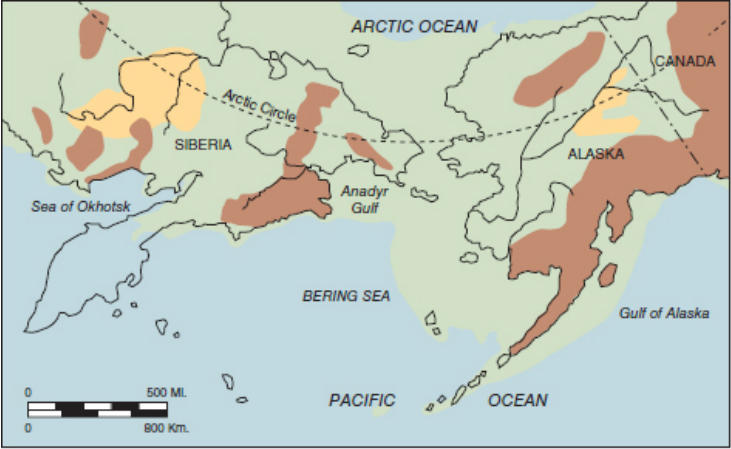
interpretation of culture change.

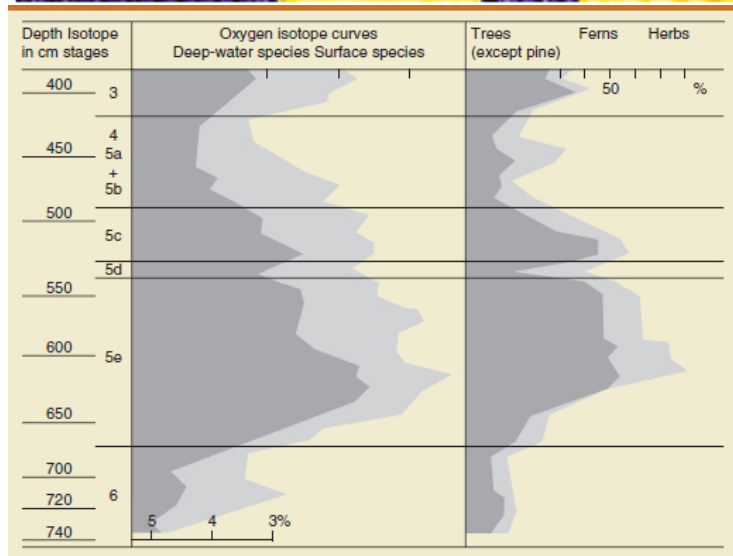
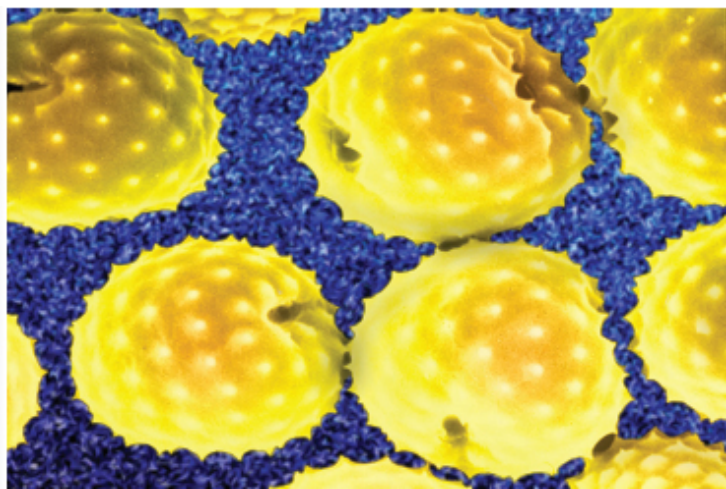


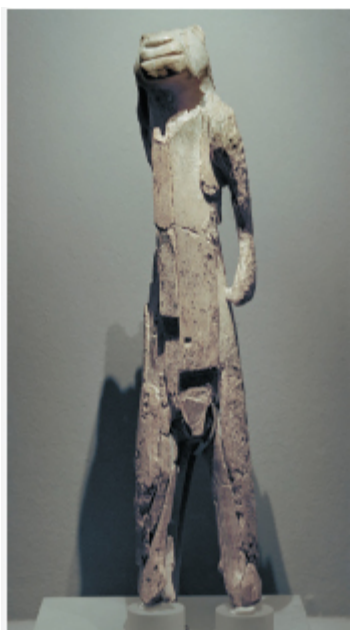


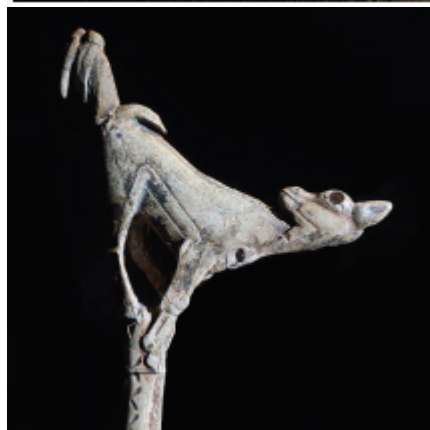












A.D./B.C.	Episodes	Conditions
A.D. 1950	Trend to warmer conditions	Warming
1850	Little Ice Age	Unpredictable, Sometimes cooler than today
1400	Medieval Warm Period	Warmer, or as warm as, today
980	Cooler and wetter	Cold winters
A.D. 1	Black Sea formed	Warming
5000	Younger Dryas	Near-glacial conditions
6000	End of the Pleistocene	
11000		
13000 B.C.		





12

Ancient Environments

CHAPTER OUTLINE

Long-Term and Short-Term Climatic Change

Geoarchaeology

Long-Term Climatic Change: The Great Ice Age

Holocene Environmental Reconstruction

Reconstructing Human-Caused Environmental Change

The White House, Canyon de Chelly, New Mexico, circa A.D. 1200.

Source: Courtesy of iStock/Thinkstock.

In 4500 B.C. , a patch of woodland in northern England boasted mature oak, ash, and elm trees, interspersed with occasional patches of open grassland and swamp. In 3820 B.C. , some foragers set fire to the forest to encourage fresh green shoots for feeding deer. Birch and bracken then appeared. About 30 years later, the landscape was cleared even more. Numerous charcoal fragments indicate that fire swept through the undergrowth, leaving fine ash to fertilize the soil. Then wheat pollen and pollen of a cultivation weed, *Plantago lanceolata*, appeared. Fifty years of wheat farming ensued. These years saw only two fires: one after 6 years, the other one 19 years after that. Then, 70 years passed, during which agriculture ceased and the land stood vacant. Hazel, birch, and alder became more common and oak resurged, as woodland rapidly gained ground.

This scenario of brief clearance, slash-and-burn agriculture, then abandonment and regeneration, was repeated at thousands of locations in ancient Europe in the early years of Stone Age farming. Over a few centuries, the natural environment of mixed-oak forest was transformed beyond recognition by gardens and domesticated animals. Until a few years ago, we could only have guessed at these environmental changes. Today, analysis of fine-grained pollen, of glacial ice cores, tree-rings and other highly sophisticated methods allow the reconstruction of even short-lived climatic and environmental changes in the remote past.

Archaeology is unique in its ability to study culture change over very long periods of time. By the same token, it is a multidisciplinary science that also studies human interactions with the natural environment over

centuries and millennia. This chapter describes some of the ways archaeologists study long- and short-term environmental change from a multidisciplinary perspective.

Long-Term and Short-Term Climatic Change

Climatic change comes in many forms. The long cycles of cold and warm associated with the Ice Age occur on a millennial scale and have long-term effects on human existence. For example, the existence of a low-lying land bridge between Siberia and Alaska during much of the late Ice Age may have allowed humans to forage their way from Asia into the Americas before 15,000 years ago, but the actual formation of the shelf that linked the two continents would have taken many centuries and human generations.

Short-term climatic changes, such as the floods or droughts caused by El Niño or the volcanic eruptions that dump ash into the atmosphere, are another matter. Memories of catastrophic famines and other results associated with such events would have endured for generations, for they had immediate impact on hundreds, if not thousands, of people. Throughout human history, people have developed strategies to deal with sudden climatic shifts, which bring drought, hunger, or unexpected food shortages. Humans have always been brilliant opportunists, capable of improvising solutions to unexpected problems caused by environmental change. Thus, environmental reconstruction and climatic change are two major concerns for archaeologists wherever they work. Current concerns over human-caused global warming and potentially catastrophic climate change in the future have made an understanding of ancient cooling and warming of particular interest.

Geoarchaeology

Geoarchaeology, which is the study of archaeology using the methods and concepts of the earth sciences, plays a major role in reconstructing ancient environments and long- and short-term climatic change (Rapp and Hill, 2006; Waters, 1997). This is a far wider enterprise than geology, and it involves at least the following four major approaches.

1. Geochemical, electromagnetic, and other remote-sensing devices to locate sites and environmental features (see [Chapter 8](#)).
2. Studies of site formation processes (see [Chapter 4](#)) and of the spatial contexts of archaeological sites, a process that includes distinguishing human-caused phenomena from natural features.
3. Reconstructing the ancient landscape by a variety of paleogeographic and biological methods, including pollen analysis.
4. Relative and chronometric dating of sites and their geological contexts (see [Chapter 7](#)).

People are geomorphic agents, just as the wind is. Accidentally or deliberately, they carry inorganic and organic materials to their homes. They remove rubbish, make tools, build houses, and abandon tools. These mineral and organic materials are subjected to all manner of mechanical and biochemical processes while people live on a site and after they abandon it. The controlling geomorphic system at a site, whatever its size, is made up not only of natural elements but also of a vital cultural component. The geoarchaeologist is involved with archaeological investigations from the very beginning and deals not only with formation of sites and with the changes they underwent during occupation but also with what happened to them after abandonment. Working closely with survey archaeologists, geoarchaeologists locate sites and other cultural features in the natural landscape using aerial photographs, satellite images, and even geophysical prospecting on individual sites. As part of this process, they examine dozens of natural geological exposures, where they study the stratigraphic and sedimentary history of the entire region as a wider context for the sites found within it. The ultimate objective is to identify not only the microenvironment of the site but also the environmental conditions of the region as a whole—to establish ecological and spatial frameworks for the socioeconomic and settlement patterns that are revealed by archaeological excavations and surveys (see [Chapter 15](#)).

DISCOVERY Moche Human Sacrifice and El Niño, Huaca De La Luna, Peru, Sixth To Seventh Century A.D.

Human sacrifice was commonplace in pre-Columbian states, among them the Aztecs and the Inca. Early Spanish accounts of these societies abound with stories of people being burned alive, flayed, decapitated, or having their hearts ripped out. Archaeological evidence for such practices is fairly rare, which makes a dramatic find of a Moche sacrifice of 1,400 years ago of unusual importance.

The Moche state controlled at least ten coastal valleys along the north coast of what is now Peru during the mid-first millennium A.D. A small elite group of so-called warrior-priests built on the political and religious traditions of earlier Andean societies to create a complex, and very wealthy, society based on irrigation agriculture and far-flung trade with highland neighbors. The nobility, probably a network of princely families, ruled from imposing temple complexes based on adobe pyramids, built by thousands of commoners who paid tribute to the state by compulsory labor, known in later centuries as *mit'a*, an ancient Andean tradition. Much of what we know about Moche society comes not from written texts but from their flamboyant visual culture, expressed in ceramics, metal artifacts, wooden sculptures, textiles, and wall paintings. A great deal of this visual culture is concerned with warfare, captured prisoners, and human sacrifice. Traditionally, this was taken “as read”: that theirs was a fierce and violent society. However, the paucity of concrete (e.g., skeletal) evidence for human sacrifice could suggest that the reality was rather different: that sacrifice was, in fact, relatively rare. On the other hand, perhaps the rarity of physical sacrificial remains is down to the massive plundering of such sites. Whatever the case, sacrifice seems to have been a highly ritualized event for the Moche, as appears to have been the case at the extraordinary discovery made at Huaca de Moche.

The greatest Moche center lay at this large, important location, dominated by two huge pyramids named after the sun and the moon. Now much eroded, they once gleamed brightly in the sunshine. Huaca de la Luna, the Temple of the Moon, has been under continual investigation since 1991 by Peruvian archaeologists Santiago Uceda and Ricardo Morales. While excavating a plaza in a secluded area of the temple, Steve Bourget uncovered a precinct surrounded by high adobe walls, built in the sixth or seventh century A.D. , where about 70 male warriors were sacrificed. Many of them were subsequently

dismembered in the course of at least five different ritual events. After their sacrifice, the victims' body parts were scattered around the ritual area, some of them accompanied by deliberately broken clay statuettes of named men, their bodies covered with elaborate symbols (see [Figure 12.1](#)). These were three-dimensional representations of individuals depicted in fine paintings.

What do these sacrifices mean? They may be ritual killings of prisoners of war, a frequent motif in Moche art and one well documented by the burials of the Lords of Sipán, dating to about A.D. 400 (see [Figure 6.4](#) on page 95). Bourget originally believed that the dead men were indeed casualties of a ritual battle, staged to placate the unknown forces that unleashed El Niño on Moche domains. But after further study, he realized that El Niño was, in fact, already fully integrated into Moche religion and ideology. The pectorals, bracelets, and other ornaments worn by the Sipán lords, and from other looted tombs, prominently depict exotic animals like the Peruvian eagle ray and swimming crabs that only arrived off the north coast when El Niño's countercurrent was flowing. The elite also wore depictions of local species affected by El Niño events, such as octopuses, catfish, seabirds, and sea lions. The temple walls of Huaca de la Luna and other shrines also bear painted reliefs of animals associated with El Niño events. Bourget theorizes that Moche rulers responded to the threat of El Niño by associating their authority with the awesome power of such events, which could transform the marine environment. When El Niño brought torrential rains that washed away entire irrigation systems and decimated the anchovy fisheries, the rulers used the occasion to reinforce their authority at times of crisis. They already wore the iconography of such events on their bodies, and caused it to be displayed on temples and on ritual vessels. Their authority came from their unique relationship with the powers of the supernatural, reinforced by human sacrifice. So they used the immolation of the 70 sacrificial victims in this particular plaza, and probably in others, to reinforce their power and to maintain social solidarity in such times of crisis.

[Figure 12.1](#) Human sacrificial victims at Huaca de la Luna, Peru.

Source: Courtesy of Jeremy Richards/Alamy Stock Photo.

Long-Term Climatic Change: The Great Ice Age

The Pleistocene Epoch was a massive era that began about 2.6 million years ago and finished around 12,000 years ago (at which point the current Holocene Epoch begins). (Incidentally, the term **Quaternary Period** is commonly used to cover both the Pleistocene and the Holocene—postglacial times, discussed later in this chapter.) The Pleistocene was remarkable for dramatic swings in world climate. On numerous occasions during the Pleistocene, great ice sheets covered much of western Europe and North America, bringing arctic climates to vast areas of the Northern Hemisphere. Scientists have identified at least eight major glacial episodes over the past 780,000 years, alternating with shorter warm periods, when the world's climate was sometimes warmer than it is today. The general pattern is cyclical, with slow coolings culminating in a relatively short period of intense cold, followed by rapid warming. For 75 percent of the past three-quarters of a million years, the world's climate has been in transition from one extreme to another. We still live in the Ice Age, in a warm interglacial period. If current scientific estimates are correct and human-caused global warming does not interfere, we will probably begin to enter another cold phase in about 23,000 years. (There is debate about introducing a new term, the Anthropocene, to distinguish the period when humans affected global climate—with some putting its start date with the Industrial Revolution and others with the dawn of farming—but we ignore this unresolved debate here.)

No one knows exactly what causes the climatic fluctuations of the Ice Age, but they are connected with oscillations in the intensity of solar radiation and the trajectory of the earth around the sun. Such climatic changes are of great importance to archaeologists, for they form a long-term environmental backdrop for the early chapters of our past. Although almost no human beings lived on, or very close to, the great ice sheets that covered so much of the Northern Hemisphere, they did live in regions affected by geological phenomena associated with the ice sheets: coastal areas, lakes, and river floodplains. When human artifacts are found in direct association with Pleistocene geological features of this type, it is sometimes possible to tie in archaeological sites with the relative chronology of Pleistocene events derived from geological strata

(Gamble, 1999).

Glacial Geology and Sea Levels

Ice Age glaciers and ice sheets formed in mountainous, high-latitude areas and on continental plains during the Pleistocene. Prolonged periods of arctic climate and abundant snowfall caused glaciers to form over enormous expanses of northern Europe, North America, and the alpine areas of France, Italy, and Switzerland. These alternated with shorter interglacial phases, when world climate was considerably warmer than it is today. Glacial geologists have identified the rubble deposits left by advancing and retreating ice sheets throughout the Northern Hemisphere. However, the processes of advance and retreat were so destructive of earlier deposits in most places that we have a clear picture of only the last two or three glacial advances.

Every ice sheet had a **periglacial** zone, an area affected by glacial climatic influences. For example, at the height of the late Ice Age some 20,000 years ago, the persistent glacial high-pressure zone centered over the northern ice sheet caused dry, frosty winds to blow over the periglacial regions of central Europe. The dry winds blew fine dust, called **loess**, onto the huge, rolling plains of central and eastern Europe and northern North America ([Figure 12.2](#)).

About 18,000 years ago, a hunter-gatherer band lived on the edge of the shallow Dnepr Valley at Mezhirich in southern Ukraine (Soffer, 1985). These people dug the floors of their semisubterranean dwellings into the soft loess soil, then roofed them with lattices of mammoth bones, using the enormous jawbones to support the roofs. Once covered with sod, the dome-like houses hugged the ground and offered excellent protection from the bitter cold winds of winter. Both radiocarbon dates and the stratified loess deposits date the Mezhirich site to within close chronological limits. Much later, around 6000 B.C. , Bandkeramik (Danubian) peoples, the first farmers of temperate Europe, settled almost exclusively on these same light loess soils, for they were eminently suitable for the simple slash-and-burn agriculture practiced by these pioneer farmers (Cunliffe, 1997). (See [Figure 12.3](#).)

The ice sheets growing on land had effects beyond the formation of loess plains. The water that fell as snow to form the ice sheets and

glaciers ultimately came from the oceans. When large areas in the northern latitudes were covered with ice, enormous quantities of water—enough to reduce the general level of the oceans by many yards, more than 295 feet (90 m) at the height of the last glaciation 18,000 years ago—were immobilized on land. This **eustatic** effect was accompanied by an **isostatic** effect as well. The sheer deadweight of the massive ice sheets sank the loaded continental blocks of the landmasses into the viscous underlying layers of the earth that lie some 6 miles (10 km) below the surface. In interglacial times, the world's sea levels rose sharply to levels higher than they are today. As the water levels retreated once again, they left their abandoned beaches raised high above later sea levels, high and dry where geologists can study them today.

Many prehistoric settlements that were occupied during periods of low sea levels are, of course, buried deep beneath the modern ocean waters. Numerous sites on ancient beaches have been found dating to times of higher sea levels. American archaeologist Richard Klein excavated a coastal cave at Nelson's Bay in the Cape Province of South Africa that now overlooks the Indian Ocean (Deacon and Deacon, 1999). Large quantities of shellfish and other marine animals are found in the uppermost levels of the cave. But in the lower levels, occupied roughly 11,000–12,000 years ago, fish bones and other marine resources are very rare. The seashore was many miles away at that time, for world sea levels were much lower during a long period of arctic climate in northern latitudes. Today, the cave is only 50 yards (45 m) from the sea.

Figure 12.2 Europe during the height of the last Ice Age glaciation.

Figure 12.3 Reconstruction of a central European farming village of about 6000 B.C. , a type built on the soft loess (glacial dust) soils of the late Ice Age.

Deep-Sea Cores and Ice Cores

The world's ocean floors are a priceless archive of ancient climatic change. Deep-sea cores produce long columns of ocean-floor sediments that include skeletons of small marine organisms that once lived close to the ocean's surface. The planktonic foraminifera (protozoa) found in

deep-sea cores consist largely of calcium carbonate. When alive, their minute skeletons absorbed organic isotopes. The ratio of two of these isotopes—oxygen-16 and oxygen-18—varies as a result of evaporation. When evaporation is high, more of the lighter oxygen-16 is extracted from the ocean, leaving the plankton to be enriched by more of the heavier oxygen-18. When great ice sheets formed on land during glacial episodes, sea levels fell as moisture was drawn off for continental ice caps. During such periods, the world's oceans contained more oxygen-18 in proportion to oxygen-16, a ratio reflected in millions of foraminifera. A mass spectrometer is used to measure this ratio, which does not reflect ancient temperature changes but is merely a statement about the size of the oceans and about contemporaneous events on land.

You can confirm climatic fluctuations by using other lines of evidence as well, such as the changing frequencies of foraminifera and other groups of marine microfossils in the cores. By using statistical techniques, and assuming that relationships between different species and sea conditions have not changed, climatologists have been able to turn these frequencies into numerical estimates of sea-surface temperatures and ocean salinity over the past few hundred thousand years and to produce a climatic profile of much of the Ice Age (see [Figure 12.4](#)). These events have been fixed at key points by radiocarbon dates and by studies of paleomagnetism (ancient magnetism). The Matuyama-Brunhes magnetic reversal of 780,000 years ago (when the world's magnetic field suddenly reversed) is a key stratigraphic marker, which can be identified both in sea cores and in volcanic strata ashore, where it can be dated precisely with potassium-argon samples.

One of the finest deep-sea cores comes from the Cariaco Basin off the coast of Venezuela in the southeastern Caribbean. The uppermost 5.5 meters of the 170-meter (558-foot) Cariaco core cover the past 14,000 years, with a sedimentation rate of about 30 centimeters per 1,000 years. So precise was the definition of the Cariaco sedimentation that an X-ray fluorescence scanner could read measurements of bulk titanium concentrations at a 2-millimeter (0.8-inch) spacing, representing intervals of only four years. Titanium concentrations reflect the amount of terrestrial sediment flowing into the Cariaco Basin, and thus provide a sequence of changing river flow and

variations in rainfall through time. A high concentration signals rainfall, a lesser one signals drier conditions. Because dry conditions in northern South America are mainly caused by El Niño events, titanium fluctuations are an accurate reflection not only of drought but also of El Niño. The Cariaco core has thrown fascinating light on the collapse of ancient Maya civilization in the southern Mesoamerican lowlands after the eighth century A.D. The exceptional definition in the core reveals a series of four major droughts, in about A.D. 760, 810, 860, and 910, the latter lasting about 6 years, spaced at about 40- to 47-year intervals, which coincides well with an estimate of a 50-year interval obtained from lake cores (558-foot) taken in the heart of the Maya homeland (Haug et al., 2003).

Figure 12.4 The deep-sea core that serves as the standard reference for the past 780,000 years comes from the Solomon Plateau in the southwestern Pacific Ocean. The Matuyama-Brunhes event occurs at a depth of 39.3 feet (11.9 m). Above it, a sawtooth-like curve identifies at least eight complete glacial and interglacial cycles.

Source: Nicholas John Shackleton and Neil D. Opdyke, "Oxygen Isotope and Paleomagnetic Stratigraphy of Equatorial Pacific Ocean Core V28-238," *Quaternary Research* 3, 1 (1973), 39-55. Copyright © 1973, with permission from Elsevier.

Ice cores are the equivalent of seabed cores, but they pose very different interpretative problems. Paleoclimatologists have drilled deep into the Greenland ice, into the Antarctic ice sheet, and into mountain glaciers and ice caps in locations as widely separated as China and Peru. Many of the interpretative problems revolve around the complex process by which annual snowfall layers are buried deeper and deeper in a glacier until they are finally compressed into ice. Scientists have had to learn the different textures characteristic of summer and winter ice so that they can assemble a long record of precipitation that goes back deep into geological time. They also use various indicators of temperature, such as carbon dioxide and methane content and other chemical properties of the ice, to estimate changes over time. Snowfall changes are especially important, for they can provide vital evidence on the rate of warming and cooling during sudden climatic changes. Researchers can now read ice cores like tree-ring samples, with very

good resolution back for 12,000 years and improving accuracy back to 40,000 years. Ice cores have been especially useful for studying not so much the long-term fluctuations of Ice Age climatic change as the short-term episodes of warmer and colder conditions that occurred in the middle of glaciations, which had profound effects on humanity. For example, scientists now suspect that there were bursts of human activity in late Ice Age western Europe about 35,000 and 25,000 years ago, when conditions were relatively warm for short periods of time (van Andel, 1997).

Figure 12.5 Climatic fluctuations over the past 420,000 years, as revealed by the Vostok ice core, Antarctica.

Ice cores reveal complex climatic changes, among them long-term changes that result from the 100,000- and 23,000-year periodicities in the earth's orbit. The Greenland cores take the story back some 150,000 years from the present, through two glacial and interglacial cycles. The same cores also chronicle rapid global warming between 15,000 and 10,000 years ago and numerous minor shifts since then (Alley, 2000).

An ice core from eastern Antarctica provides a continual climatic record from 800,000 years ago and covers eight glacial cycles. An international team of scientists drilled another core to a depth of 11,886 feet (3,623 m) through the Antarctic ice sheet at the Russian Vostok Station. The drillers stopped 394 feet (120 m) short of the vast subglacial lake that lies under the ice to avoid contaminating it with drilling fluid (Pettit et al., 1999). The Vostok ice core takes us to about 420,000 years ago, through four transitions from glacial to warm periods. These shifts came at about 100,000-year intervals, the first about 335,000 years before present, then at 245,000, 135,000, and 18,000 years ago—a cyclical rhythm. There seem to be two periodicities involved, a primary one of about 100,000 years and another weaker one of about 41,000 years. Together, they support the long-held theory that changes in the orbital parameters of the earth—eccentricity, obliquity, and precession of axis—cause variations in the intensity and distribution of solar radiation. These, in turn, trigger natural climatic changes on a grand scale (see [Figure 12.5](#)). Even earlier ice records come from the Allan Hills, also in Antarctica, and date back to about 2.7 million years, when CO₂ levels were much lower than today.

The Greenland and Vostok cores also document major changes in atmospheric concentrations of CO₂ (carbon dioxide) and CH₄ (methane), the most important greenhouse gases. All of the four Vostok transitions from glacial to warmer periods were accompanied by *increases* in atmospheric CO₂ from about 180 to 300 parts per million by volume. (The present level, in a world warmed by human activity, is around 365 parts per million.) At the same time, atmospheric CH₄ rose from about 320–350 parts per billion per volume to 650–770 parts per billion. Why CO₂ levels increased so rapidly during these four transitions is unknown, but many experts believe that sea surface temperatures in the Southern Ocean played a key role in triggering changes in the atmosphere. The Greenland ice cores show clearly that shifts in CH₄ levels coincide with fast and major temperature changes in the Northern Hemisphere.

If these connections are correct, we can discern a sequence of events that unfolded not only at the beginning of the Holocene but also in earlier transitions. First, changes in orbital parameters of the earth triggered the end of a glacial period. Next, an increase in greenhouse gasses amplified the weak orbital signal. As the transition progressed, the decreased albedo (solar reflection) caused by rapid melting of the vast ice sheets in the Northern Hemisphere amplified the rate of global warming.

In providing a detailed record of the beginnings and endings of all the glacial periods of the past 420,000 years, the Vostok core shows us that the world's climate has almost always been in a state of change over these 420 millennia. But until the Holocene, it has always oscillated. The Holocene climate breaks through these boundaries. In duration, in stability, in the degree of warming, and in concentration of greenhouse gases, the warming of the past 15 millennia exceeds any in the Vostok or Greenland records. Civilization arose during a remarkably long climatic summer. We still have no idea when, or how, that summer will end.

Ice cores also provide evidence of medium-range shifts between 5,000 and 10,000 years in duration and data of particular importance to archaeologists but still little understood: high-frequency climatic changes with periodicities of about 1,000 years. All three types of climatic change interact in the ice-core record, which looks rather like a

wave diagram of a radio playing three stations at once.

Some paleoclimatologists believe that changes in arctic climate may have triggered changes elsewhere in the world, reflected in such phenomena as pollen records in Florida lakes, glacial records in the Andes, and ocean-bottom sediments in the Santa Barbara Channel, California. Ice-core research is also providing convincing evidence of drought cycles and other climatic fluctuations during the Holocene (discussed later in this chapter).

Ice and sea cores, combined with pollen analysis, have provided a broad framework for the Pleistocene, which is in wide use by archaeologists. It is worth summarizing here.

The Pleistocene Framework

The Pleistocene began about 2.6 million years ago, during a long-term cooling trend in the world's oceans. These millennia were ones of constant climatic change (Figure 12.6). The Pleistocene is conventionally divided into three long subdivisions.

The *Lower Pleistocene* lasted from about 2.6 million years ago until about 780,000 years ago. Deep-sea cores tell us that climatic fluctuations between warmer and colder regimes were still relatively minor. These were critical millennia, for it was during this long period that humans first spread from tropical regions in Africa to other regions and then into temperate latitudes in Europe and Asia.

Figure 12.6 The darker areas indicate the distribution of major ice sheets in Europe and North America during the maximum Ice Age glaciation, and the lighter areas show the extent of land exposed by low sea levels.

The *Middle Pleistocene* began with the Matuyama-Brunhes reversal in the earth's magnetic polarity, about 780,000 years ago, a change that has been recognized geologically not only in deep-sea cores but also in volcanic rocks ashore, where it can be dated by potassium-argon samples.

Since then, there have been at least eight cold (glacial) and warm (interglacial) cycles, the last cycle ending about 12,000 years ago. (Strictly speaking, we are still in an interglacial today.) Typically, cold cycles have begun gradually, with vast continental ice sheets forming

on land—in Scandinavia, on the Alps, and over the northern parts of North America (see [Figure 12.6](#)). These expanded ice sheets locked up enormous quantities of water, causing world sea levels to fall by several hundred feet during glacial episodes. The geography of the world changed dramatically, and large continental shelves were opened up for human settlement. When a warming trend began, deglaciation occurred very rapidly and rising sea levels flooded low-lying coastal areas within a few millennia. During glacial maxima, glaciers covered a full one-third of the earth's land surface, whereas during interglacials, they were as extensive as they are today.

Throughout the past 780,000 years, vegetational changes have mirrored climatic fluctuations. During glacial episodes, treeless arctic steppe and tundra covered much of Europe and parts of North America but gave way to temperate forest during interglacials. In the tropics, Africa's Sahara Desert may have supported grassland during interglacials, but ice and desert landscape expanded dramatically during dry, cold spells.

The *Upper Pleistocene* stage began about 128,000 years ago, with the beginning of the last interglacial. This period lasted until about 118,000 years ago, when a slow cooling trend brought full glacial conditions to Europe and North America. This is traditionally known as the Würm glaciation, named after a river in the Alps, lasted until about 15,000 years ago, when there was a rapid return to more temperate conditions.

The Würm glaciation was a period of constantly fluctuating climatic change, with several episodes of more temperate climate in northern latitudes (see [Figure 12.4](#) on page 228). It served as the backdrop for some of the most important developments in human prehistory, notably the spread of anatomically modern humans from the tropics to all parts of the Old World and into the Americas. Between about 30,000 and 15,000 years ago, northern Eurasia's climate was intensely cold but highly variable. A series of Stone Age hunter-gatherer cultures evolved both on the open tundra of central Europe and Eurasia and in the sheltered river valleys of southwestern France and northern Spain, cultures famous for their fine antler and bone artifacts and exceptional artwork (Bahn, 2016).

The world's geography was dramatically different 18,000 years ago during the last glacial maximum. These differences had a major impact

on human prehistory; one could walk from Siberia to Alaska across a flat, low-lying plain, the Bering Land Bridge (see [Figure 12.7](#)). This was the route by which humans first reached the Americas some time before 12,000 years ago—although some scholars espouse a coastal settlement instead (Meltzer, 2008). The low-lying coastal zones of Southeast Asia were far more extensive 15,000 years ago than they are now, and they supported a thriving population of Stone Age foragers. The fluctuating distributions of vegetational zones also affected the pattern of human settlement and the course of human history.

[Figure 12.7](#) The Bering Land Bridge, as reconstructed by multidisciplinary research. Alaska finally separated from Siberia about 11,000 years ago as sea levels rose in response to warmer conditions.

Pollen Analysis

As long ago as 1916, Swedish botanist Lennart von Post used fossil pollen grains from such familiar trees as birches, oaks, and pines to develop a sequence of vegetational change for northern Europe after the Ice Age (Erdtman, 2008). He showed how arctic, treeless tundra gave way to birch forest, and then mixed oak woodland in a dramatic sequence of change that survived in pollen samples from marshes and swamps all over Scandinavia. Since then, **pollen analysis (palynology)** has become a highly sophisticated way of studying both ancient environments and human impacts on natural vegetation.

Pollen analysis reconstructs ancient vegetational change and gives insights into the ways people adapted to shifting climatic conditions. For instance, palynology is providing new perceptions of Stone Age life at the height of the last glaciation in southwestern France, some 15,000–20,000 years ago (Gamble, 1999). (See [Figure 12.2](#) on page 226.) This was, we have been told, a period of extreme arctic cold, when Europe was in a deep freeze, and people subsisted on arctic animals and took refuge in deep river valleys such as the Dordogne and the Vézère, where some of the earliest cave art in the world has been discovered. In fact, pollen grains from the rock shelters and open camps used by Stone Age hunter-gatherers of this period paint a very different picture of the late Ice Age climate in this area. It is a portrait of a favored arctic environment in which the climate fluctuated constantly, with

surprisingly temperate conditions, especially on the south-facing slopes of deep river valleys. Here, people used rock shelters that faced the winter sun, where snow melted earlier in the spring, within easy reach of key reindeer migration routes and of arctic game that wintered in the valleys. The vegetational cover was not treeless, as is commonly assumed, but included pine, birch, and sometimes deciduous trees, with lush summer meadows in the valleys.

The late Ice Age was a period of continual, and often dramatic, short- and long-term climatic change. Some of these changes lasted millennia, bringing intervals of near-modern conditions to temperate Europe, interspersed with much colder winters. Other cold and warm snaps extended over a few centuries, causing human populations to adapt to dramatically new conditions. Just as there are today, there were much shorter climatic episodes, which endured for a year or more, bringing unusually warm summers, floods, droughts, and other short-term events (see the People of the Past box).

Doing Archaeology The Principles of Pollen Analysis

The principle is simple: Large numbers of pollen grains are dispersed in the atmosphere and survive remarkably well if deposited in an unaerated geological horizon. The pollen grains can be identified microscopically (see [Figure 12.8](#)) with great accuracy and can be used to reconstruct a picture of the vegetation, right down to humble grasses and weeds that grew near the spot where the pollen grains are found.

Pollen analysis begins in the field. The botanist visits the excavation and collects a series of closely spaced pollen samples from the stratigraphic sections at the site. Back in the laboratory, the samples are examined under a very powerful microscope. The grains of each genus or species present are counted, and the resulting numbers are subjected to statistical analysis. These counts are then correlated with the stratigraphic layers of the excavation and data from natural vegetational sequences to provide a sequence of vegetational change for the site. Typically, this vegetational sequence lasts a few centuries or even millennia (see [Figure 12.9](#)). It forms part of a much longer pollen sequence for the area that has been assembled from hundreds of samples from many different sites. In northern Europe, for example, botanists have worked out a complicated series of vegetational time

zones that cover the past 12,000 years. By comparing the pollen sequences from individual sites with the overall chronology, botanists can give a relative date for the site.

Palynology has obvious applications to prehistory, for sites are often found in swampy deposits where pollen is preserved, especially fishing or fowling camps and settlements near water. Isolated artifacts, or even human corpses (such as that of Tollund Man, found in a Danish bog; see [Figure 4.4](#) on page 68), have also been discovered in these deposits; pollen is sometimes obtained from small peat lumps adhering to crevices in such finds. Thus, botanists can assign relative dates even to isolated finds that would otherwise remain undated.

[Figure 12.8 Pollen grains of ragweed.](#)

Source: Courtesy of BSIP SA/Alamy Stock Photo.

Until recently, pollen analysts dealt in centuries. Now, thanks to much more refined methods and accelerator mass spectrometry (AMS) radiocarbon dating, they can study even transitory episodes, such as the brief farming incident described at the beginning of this chapter (see also [Chapter 7](#)). For example, dramatic declines in forest tree pollens at many locations in Europe chronicle the first clearances made by farming cultures with almost decade-long accuracy—at a moment when characteristic cultivation weeds such as *Plantago lanceolata* appear for the first time. In the United States, Southwestern archaeologists now have a regional pollen sequence that provides not only climatic information but also valuable facts about the functions of different pueblo rooms and different foods that were eaten by the inhabitants.

[Figure 12.9](#) A long-term pollen sequence for the Ice Age from Spain (*right*) compared with oxygen isotope curves taken from a deep-sea core in the nearby Bay of Biscay (*left*), showing the close correlation between the two.

Holocene Environmental Reconstruction

With the rapid retreat of late Ice Age glaciers 15,000 years ago, the world entered a period of profound environmental change that saw the great ice sheets of northern latitudes melt and world sea levels rise to modern levels (see [Figure 12.10](#)). Thus dawned the **Holocene Epoch**

(Greek *holos*, “recent”), which saw massive global warming, sudden cold episodes, periods of warmer climate than today, and the appearance of both food production and civilization, as well as the Industrial Revolution. Many people believe this warming has been continuous and is reflected in the record warm temperatures of today. In fact, the world’s climate has fluctuated just as dramatically as it did during the late Ice Age. Recent research is revolutionizing our knowledge of these changes over the past 11,300 years, which started new chapters in human history, overthrew civilizations, and caused widespread disruption (Marcott et al., 2013).

Figure 12.10 Great Britain and Scandinavia at the end of the Ice Age, showing sea levels around 7000 B.C.

We can identify Holocene climatic changes from ice cores, sedimentary records in caves, tree rings, and pollen samples with a chronological resolution that improves every year as analytical methods become ever more refined. For example, the famous Stone Age Star Carr forager camp in northeastern England has been dissected with the aid of highly refined pollen analysis (Mellars and Dark, 1999), AMS radiocarbon dating, and minute studies of wood charcoals and soils. Researchers believe that the site was occupied repeatedly for about 350 years around 8500 B.C. The inhabitants burned the lakeside vegetation repeatedly and built a substantial wooden platform in the reeds. The platform was part of a much larger settlement on nearby dry land than was originally thought when the site was excavated in the late 1940s.

The onset of the Holocene coincided with a period when Stone Age foragers had occupied virtually all inhabitable parts of the Old World, except the offshore Pacific Islands. By this time, too, a tiny number of humans had probably foraged their way into the Americas. Wherever they flourished, the people of the early Holocene had to adjust to radically new, and often very challenging, environmental conditions. Over a period of a mere 5,000 years, hundreds of familiar, large Ice Age animals such as the mammoth, Ice Age bison, and arctic rhinoceros became extinct. People turned to far more intensive exploitation of local environments. Many became specialized hunters or fishers or concentrated on plant foods to the virtual exclusion of all other resources. And some became farmers, changing the course of human

history (Fagan, 2004).

Centuries-Long Climatic Changes: The Younger Dryas and the Black Sea

At least three major cold episodes have cooled global temperatures since 15,000 years ago (see [Figure 12.10](#)). The last of these was the so-called Little Ice Age, a global event of sometimes markedly colder conditions that lasted from A.D. 1400 to 1850. The earlier two of these cold intervals, the Younger Dryas and the Black Sea episode, had major effects on the course of human history, which we can now assess with new deep-sea core, ice-core, and pollen researches.

People of The Past A Portrait of Cro-Magnons, 18,000 Years Ago

In 1858, workers constructing the foundations of the Les Eyzies railroad station in southwestern France inadvertently dug into a long-forgotten rock shelter. They soon uncovered flint tools, butchered reindeer bones, and the skeletons of two round-headed, thoroughly modern-looking people dating to a time when the climate was much colder than today. The find came two years after the beetle-browed skull of Neanderthal man had come to light in Germany, clearly a more archaic person than the Les Eyzies burials. A century and a half later, generations of excavations and detailed analysis have painted a compelling portrait of the first truly modern Europeans, commonly known as the Cro-Magnons, after the Les Eyzies rock shelter where they first came to light. These hunter-gatherers flourished through western and central Europe from before 43,000 years ago until the end of the Ice Age some 14,000 years before present, and probably even later (Fagan, 2009a).

What do we know about the Cro-Magnons? We can identify with them at a superficial level because, being anatomically modern humans, they would have been just like us and with the same cognitive abilities as we do. But their material and spiritual worlds were unimaginably remote from our own, defined by the challenge of the bitterly cold winters and short, warm summers of the late Ice Age. Most Cro-Magnon groups lived in relatively sheltered locations in central and western Europe, only venturing into more open country to the north

when hunting during the warm months. They lived in sheltered valleys like those of the Dordogne area of southwestern France, making use of caves and large rock shelters, living mostly in south-facing locations close to water, where the sun provided natural warming. Their homeland abounded in cold-tolerant animals: bison, aurochs (the wild ox), deer, elk, boar, and all kinds of smaller animals and birds.

Figure 12.1a An anthropomorphic figure from Stadel Cave, Germany, circa 32,000 years B.P. Source: Ulmer Museum.

To survive in such an environment of extremes meant diversification—and the full use of a simple but highly effective stone technology. The Cro-Magnons invented the Ice Age equivalent of the Swiss Army knife, with finely shaped flint nodules serving as the chassis for a whole range of different artifacts such as knives, scrapers, awls, and spear points, each made on parallel-sided, thin blades struck off the chassis (or core) with a punch.

Figure 12.1b A stoneworker demonstrates blade manufacture with an antler punch. Various tools were used to strike off the blades—a handheld punch (as [here](#)) or a longer chest-impelled punch. The punch allows intense pressure to be applied to a single point on the top of the core and channels the direction of the shock waves.

The most important of these artifacts was a chisel-like tool known as a burin, which allowed its owner to cut deep grooves in fresh antler and bone. Long splinters from antlers were the equivalent to the blades of a Swiss Army knife. Burins, but one stone artifact among dozens, opened up a whole new world of technology, which revolutionized human life. Fine bone or ivory needles with perforated eyes appear before 25,000 years ago. These allowed the women to make layers of carefully tailored garments made of hide and fur. Judging from modern Eskimo practice, they used different furs for specific purposes. Eskimo seamstresses use wolf fur for anorak hoods, for example. Arctic fox fur is ideal for leggings and inner shoes. We can be certain that the Cro-Magnons had just as a sophisticated knowledge of furs and hides, hunting some species like arctic fox for their furs.

Survival in the late Ice Age world meant coping with dramatic temperature changes with layered clothing, being able to work outside

in subzero temperatures, and using highly portable, extremely efficient, and easily replaceable hunting weapons and tools. We know from the finds in French rock shelters that the Cro-Magnons used antler harpoons and spearheads mounted in foreshafts to pursue their prey. Even with spear-throwers to propel the spears farther, the hunters had to be adept at stalking. Imagine approaching within a few feet of an unsuspecting bison with no weaponry that allows you to shoot it from afar. You would kill the animal by getting as close as possible, hitting it in a vital spot, or by wounding it severely and then following it until it weakened—if another predator didn't get it first. A Cro-Magnon hunter had to be tough and resourceful.

The Cro-Magnons were nonliterate, so all knowledge—of hunting and plants, of medicines, and the challenges of the environment—had to be passed from one generation to the next by word of mouth. This is probably one of the reasons why these late Ice Age people were among the first artists in history. Their carvings, engravings, and rock paintings served as a link between the living and spiritual world, and as a mnemonic, as it were, for the chants, songs, stories, and rituals that passed on knowledge to future generations. Everyone's survival depended on experience, cooperation with others, caution, and skill acquired over thousands of years.

Figure 12.1c Wild oxen, horses, and woolly rhinoceroses painted on the walls of the Grotte de Chauvet.

Figure 12.1d A wild ox painted on the walls of Lascaux Cave, France.

Source: Courtesy of Hemis/Alamy Stock Photo.

We can imagine a Cro-Magnon hunter about to leave on a hunt. He sets off with a small band. He carries a spear-thrower and antler-tipped spears and harpoons, also a fiber net for trapping small animals. A leather quiver holds spare spear points and foreshafts. He may wear a hooded anorak and long pants tucked into stout skin boots adorned with arctic fox fur. His face is deeply weathered by harsh winds and bitter cold, yet his teeth are strong and white, neither tarnished by sugar nor weakened by habitually biting onto farmed grains. His hair is long, worn over the shoulders or in a braid. His necklace of bear teeth

and seashells was obtained in trade with another band during a summer gathering. Vertical painted stripes on his face are a sign of kin affiliation. Our Cro-Magnon moves silently into the shade of the nearby pine trees, watching for reindeer at the edge of the clearing... .

Figure 12.1e A Magdalenian spear thrower from Mas D’Azil, Ariège. The weight and hook are in the form of a mountain goat (ibex) looking back at its tail.

Source: Album/Alamy Stock Photo.

The Younger Dryas This period lasted from 12,900 to 11,500 years ago. For some still little understood reason, global warming abruptly ceased, perhaps as a result of sudden changes in the warm water circulation in the Atlantic. A huge glacial lake formed by retreating ice sheets over what is now Canada burst its banks, sending millions of gallons of fresh water into the North Atlantic. The water cascaded over the surface of the ocean and shut down virtually all circulation of heavier salt water from the surface to the depths of the Atlantic, shutting down the Gulf Stream. Within a few generations, Europe again shivered under near-Ice Age conditions, as forests retreated and widespread drought affected areas such as southwestern Asia. This catastrophic drought after centuries of ample rainfall may have been a major factor in the appearance of agriculture and animal domestication in such areas as the Euphrates and Jordan River valleys, where dense forager populations had long subsisted off abundant food resources.

Figure 12.11 Major climatic and historical events of the Holocene. (This is, of course, a gross simplification of reality.)

What happened next has been documented by botanist Gordon Hillman with plant remains at the Abu Hureyra site in Syria’s Euphrates River valley (Hillman et al., 1989; Moore, 2000). (See [Chapter 13](#).) When the drought came, nut harvest yields plummeted, game populations crashed, and wild cereal grasses were unable to support a dense human population. So the foragers turned to cultivation to supplement their food supplies. Within a few generations, they became full-time farmers.

The Younger Dryas–induced drought was not the only cause of the development of agriculture, but the sudden climate change was of

importance. The same economic shift was repeated at many locations, and, within a few centuries, agriculture was widespread throughout southwestern Asia. Thanks to accurate radiocarbon dating of individual seeds and pollen grains from freshwater lakes, archaeologist Andrew Moore and his colleagues were able to tie the changeover to farming to the 1,000-year-long Younger Dryas (Moore, 2000).

The Black Sea This was an enormous freshwater lake (often called the Euxine Lake) isolated from the Mediterranean by a huge natural earthen levee in the Bosphorus Valley between Turkey and Bulgaria during the early Holocene. Four centuries of colder conditions and drought again settled over Europe and southwestern Asia between 6200 and 5800 B.C. Many farmers abandoned long-established villages and settled near the great lake and other permanent water sources. Deepsea cores and pollen diagrams chronicle what happened next as the climate warmed up again after 5800 B.C. Sea levels resumed their inexorable rise toward modern high levels, and salty Mediterranean waters climbed ever higher on the Bosphorus levee. Then, in about 5500 B.C. , the rising water breached the barrier. Quite what happened then is a matter of controversy. One scenario envisages torrents of saltwater cascading into the Euxine Lake 500 feet (150 m) below. Within weeks, the great waterfall had carved a deep gully and formed the narrow strait that now links the Black Sea to the Mediterranean. The former lake not only became a saltwater sea but also rose sharply, flooding hundreds of agricultural settlements on its shores and 2,000 square miles (70,000 sq. km) of farmland, perhaps with great loss of life (Ryan and Pitman, 1998). Another scenario, using cores bored into the Danube estuary, suggests that the flood was less catastrophic and flooded only about 7702 square miles (2,000 sq. km) of prime agricultural land. Deep-sea cores taken in the Mediterranean and in the Black Sea chronicle not only the cold episode and drought but also the sudden change in the now-drowned lake. While no one doubts that the Euxine Lake became part of the Mediterranean, the historical effects of the flooding and its nature and suddenness are the subject of continued debate. The flooding of the huge lake does coincide with the spread of farmers across temperate Europe from the Balkans. Some experts believe the environmental catastrophe and the spread of farming were connected,

as people fled their once-fertile homelands.

Short-Term Climatic Change: El Niño

The Younger Dryas and Black Sea drought and flood were centuries-long events but are considered short by geological and early prehistoric standards. It is only now that we are beginning to understand their profound impact on ancient societies. As research into these and other centuries-long events has intensified, scholars have paid increasing attention to violent, yearlong episodes such as monsoon failures, volcanic eruptions, and, most important of all, El Niño.

Identifying ancient short-term climatic change requires extremely precise and sophisticated environmental and climatic evidence, much of it obtained from ice cores, pollen diagrams, and tree rings. Ice cores, in particular, are revolutionizing our knowledge of ancient climatic shifts, for they are now achieving a resolution of five years or less, which allows one to study drought cycles and major El Niño events of the past.

El Niño events, such as those in 1982–1983 and 1997–1998 have grabbed world headlines, and with good reason (Fagan, 2009b; Sarachik and Cane, 2010). Billions of dollars of damage resulted from drought and flood. California experienced record rains; Australia and northeastern Brazil suffered through brutal drought; enormous wildfires devastated rain forests in Southeast Asia and Mexico. Once thought to be a purely local phenomenon off the Peruvian coast, El Niño episodes are now known to be global events that ripple across the entire tropics as a result of a breakdown in the atmospheric and oceanic circulation in the western Pacific. From the archaeologist's point of view, El Niño events are of compelling interest, for they had drastic effects on many early civilizations living in normally dry environments, where flooding may have wiped out years of irrigation agriculture in hours. Humanity was not that vulnerable to El Niño until people settled in permanent villages, then cities, when the realities of farming and growing population densities made it harder for them to move away from drought or flood.

A classic example of such vulnerability comes from the northern coast of Peru, where the Moche civilization flourished around A.D. 400,

ruled by authoritarian warrior-priests (see [Figure 1.9](#) on page 18). The Moche survived in one of the driest environments on earth by using elaborate irrigation schemes to harness spring runoff from the Andes in coastal river valleys. Everything depended on ample mountain floodwaters. When drought occurred, the Moche suffered (Moseley, 2000).

The Quelccaya ice cap in the Cordillera Occidental of the southern Peruvian highlands lies in the same zone of seasonal rainfall as the mountains above Moche country. Two ice cores drilled in the summit of the ice cap in 1983 provide a record of variations in rainfall over 1,500 years (Thompson, 1986; Thompson et al., 1984) and, indirectly, an impression of the amount of runoff that would have reached lowland river valleys during cycles of wet and dry years. In the southern highlands, El Niño episodes have been tied to intense short-term droughts in the region and on the nearby *altiplano*, the high-altitude plains around Lake Titicaca. The appearance of such drought periods in the ice cores may reflect strong El Niño events in the remote past. However, it is more productive to look at long-term dry and wet cycles.

The two ice cores, 508 and 537 feet (154.8 and 163.6 m) long, each yielded clear layering and annual dust layers that reflected the yearly cycle of wet and dry seasons, the latter bringing dust particles from the arid lands of the west to the high Andes; they are accurate to within about twenty years. The cores show clear indications of long-term rainfall variations. A short drought occurred between A.D. 534 and 540. Then, between A.D. 563 and 594, a three-decade drought cycle settled over the mountains and lowlands, with annual rainfall as much as 30 percent below normal. Abundant rainfall resumed in A.D. 602, giving way to another drought between A.D. 636 and 645.

The 30-year drought of A.D. 563–594 drastically reduced the amount of runoff reaching coastal communities. The effect of a 25 or 30 percent reduction in the water supply would have been catastrophic, especially to farmers near the coast, well downstream from the mountains. Moche society apparently prospered until the mid-sixth century's severe drought cycle. As the drought intensified, the diminished runoff barely watered the rich farming lands far downstream. Miles of laboriously maintained irrigation canals remained dry. Blowing sand cascaded into empty ditches. By the third or fourth year, as the drought lowered the

water table far below normal, thousands of acres of farmland received so weak a river flow that unflushed salt accumulated in the soil. Crops withered. Fortunately, the coastal fisheries still provided ample fish meal—until El Niño came along without warning, bringing warmer waters and torrential rains to the desert and mountains.

We do not know the exact years during the long drought when strong El Niño events occurred, but we can be certain that they did. We can also be sure they hit at a time when Moche civilization was in crisis—grain supplies running low, irrigation systems sadly depleted, malnutrition widespread, and confidence in the rulers' divine powers much diminished. The warmer waters of El Niño reduced anchovy harvests in many places, decimating a staple of both the coastal diet and the highland trade. Torrential rains swamped the Andes and coastal plain. The dry riverbeds became raging torrents, carrying everything before them. Levees and canals overflowed and collapsed. The arduous labors of years vanished in a few weeks. Dozens of villages vanished under mud and debris as the farmers' cane-and-adobe houses collapsed and their occupants drowned. The floods polluted springs and streams, overwhelmed sanitation systems, and stripped thousands of acres of fertile soil. As the water receded and the rivers went down, typhoid and other epidemics swept through the valleys, wiping out entire communities and eroding fertile soils. Infant mortality soared.

The Moche's elaborate irrigation systems created an artificial landscape that supported dense farming populations in the midst of one of the driest deserts on the earth, where farming would be impossible without technological ingenuity. The farmers were well aware of the hazards of droughts and El Niño episodes, but technology and irrigation could not guarantee the survival of a highly centralized society driven as much by ideology as by pragmatic concerns. There were limits to the climatic shifts Moche civilization could absorb. Ultimately, the Moche ran out of options and their civilization collapsed.

We do not know how long El Niño events have oscillated across the globe, but they have descended on Peru for at least 5,000 years. A new generation of climatic researches from ice cores and other data shows that short-term climatic shifts played a far more important role in the fate of early civilizations than was once realized.

Tree Rings: Studying Southwestern Drought

Many ancient societies lived in environments with unpredictable rainfall, where agriculture was, at best, a chancy enterprise. The ancient peoples of the southwestern United States farmed their semiarid environment with brilliant skill for more than 3,000 years, developing an extraordinary expertise at water management and plant breeding. One central philosophy of modern-day Pueblo Indian groups surrounds movement, the notion that people have to move to escape drought and survive. Until recently, archaeologists did not fully appreciate the importance of movement in Southwestern life and were at a loss to explain the sudden dispersal of the Ancestral Pueblo people of Chaco Canyon and the Four Corners region in the twelfth and thirteenth centuries A.D.

The Ancestral Pueblo dispersal can be better understood by dividing the relationship between climatic change and human behavior into three broad categories. Certain obvious stable elements in the Ancestral Pueblo environment have not changed over the past 2,000 years, such as bedrock geology and climate type. Then there are low-frequency environmental changes—those that occur in cycles longer than a human generation of 25 years. Few people witnessed these changes during their lifetimes. Changes in hydrological conditions, such as cycles of erosion and deposition along watercourses, fluctuations in water table levels in river floodplains, and changes in plant distributions, transcend generations, but they could affect the environment drastically, especially in drought cycles.

Shorter-term, high-frequency changes were readily apparent to every Ancestral Pueblo: year-to-year rainfall shifts, decade-long drought cycles, seasonal changes, and so on. Over the centuries, the Ancestral Pueblo were probably barely aware of long-term change, because the present generation and its immediate ancestors experienced the same basic adaptation, which one could call a form of “stability.” Cycles of drought, unusually heavy rains, and other high-frequency changes required temporary and flexible adjustments, such as farming more land, relying more heavily on wild plant foods, and, above all, movement across the terrain (see the Doing Archaeology box).

Such strategies worked well for centuries, as long as the Ancestral

Pueblo farmed their land at well below its carrying capacity. When the population increased to near carrying capacity, however, as it did at Chaco Canyon in the twelfth century, people became increasingly vulnerable to brief El Niño events or droughts, which could stretch the supportive capacity of a local environment within months, even weeks. Their vulnerability was even more extreme when long-term changes—such as a half-century or more of much drier conditions—descended on farmlands already pushed to their carrying limits. Under these circumstances, a year-long drought or torrential rains could quickly destroy a local population's ability to support itself. So the people dispersed into other areas, where there were better water supplies and ample soil. Without question, the Ancestral Pueblo dispersed from Mesa Verde and Chaco Canyon because drought forced them to do so (Fagan, 2005). Unlike the Moche in distant Peru, they had the flexibility to move away.

The coming decades will see a revolution in our understanding of ancient environments and short-term climatic change, as scientists acquire a better knowledge both of climates in the past and of the still little-known forces that drive the global weather machine. Like our predecessors, we still live in the Ice Age, which, some estimates calculate, will bring renewed glacial conditions in about 23,000 years. Therefore, it is hardly surprising that, like our forebears, we have had to adjust to constant short-term climatic changes. And, as human-induced global warming accelerates, these changes may become more frequent and violent, spelling danger for an overpopulated world.

Doing Archaeology Climatic Variability in the Ancient American Southwest

Dendrochronologies for the Ancestral Pueblo are now accurate to within a year, giving us the most precise timescale for any early human society anywhere. In recent years, the Laboratory of Tree-Ring Research at the University of Arizona has undertaken a massive dendroclimatic study that has yielded a reconstruction of relative climatic variability in the Southwest from A.D. 680 to 1970 (Dean, 1988; Dean and Funkhauser, 1994). The same scientists, headed by Jeffrey Dean, are now producing the first quantitative reconstructions of

annual and seasonal rainfall and of temperature, drought, and stream flow for the region. Such research involves not only tree-ring sequences but also intricate mathematical expressions of the relationships between tree growth and such variables as rainfall, temperature, and crop yields. These calculations yield statistical estimations of the fluctuations in these variables on an annual and seasonal basis.

By using a spatial grid of 27 long tree-ring sequences from throughout the Southwest, Dean and his colleagues have compiled maps that plot the different station values and their fluctuations like contour maps, one for each decade. These maps enable them to study such phenomena as the progress of what Dean sometimes calls the “Great Drought” of A.D. 1276–1299 from northwest to southeast across the region. In 1276, the beginnings of the drought appear as negative standard deviations from average rainfall in the Northwest, while the remainder of the region enjoys above-average rainfall. During the next ten years, very dry conditions expand over the entire Southwest before improved rainfall arrives after 1299. This form of mapping allows close correlation of vacated large and small pueblos with short-term climatic fluctuations.

When the research team looked at the entire period from A.D. 966 to 1988, they found that the tree-ring stations in the northwestern region accounted for no less than 60 percent of the rainfall variance. In contrast, stations in the southeastern part of the Southwest accounted for only 10 percent. This general configuration, which persisted for centuries, coincides with the modern distribution of seasonal rainfall in the Southwest: Predictable summer rainfall dominates the southeastern areas, while the Northwest receives both winter and summer precipitation (Figure 12.12). Winter rains are much more uncertain. When the scientists examined this general rainfall pattern at 100-year intervals from 539 to 1988, they observed that it persisted most of the time, even though the boundary between the two zones moved backward and forward slightly.

But this long-term pattern broke down completely from A.D. 1250 to 1450, when a totally aberrant pattern prevailed in the Northwest. The Southeast remained stable but there was major disruption elsewhere. For nearly two centuries, the relatively simple long-term pattern of summer and winter rains gave way to complex, unpredictable

precipitation and severe droughts, especially on the Colorado Plateau. This change to an unstable pattern would have had a severe impact on Ancestral Pueblo farmers, especially since it coincided with the Great Drought of A.D. 1276–1299.

Figure 12.12 The climatic regimes of the American Southwest, showing the general configuration of rainfall across the region, reconstructed with tree-ring data. The Northwest receives both summer and winter rainfall; in the Southeast, only summer rainfall is predictable.

Reconstructing Human-Caused Environmental Change

One of the great misconceptions of history proclaims that most preindustrial societies lived in exquisite ecological balance with their natural environments. Although it is true that the imprint of a small forager group on the landscape is rarely catastrophic, many early societies used fire to burn off dead grass and stimulate new growth for game to feed on or to grow edible grasses, with long-term effects on the natural vegetation. However, the relationship between humans and their environments changed dramatically with the advent of agriculture and animal domestication.

S i T E > Environmental Archaeology at Vindolanda, North England <

After the Romans landed in Britain, they began their quest to dominate the whole country, pushing forward at all quarters. At around A.D. 85, following a major battle with the northern tribes, they established a fort at the place they called Vindolanda. This fort guarded the middle section of a critical east-west supply route, known now as the Stanegate. Some 40 years later, when Hadrian's Wall was built, Vindolanda took its place as a wall fort ([Figure 12.13](#)).

To archaeologists, Vindolanda is a veritable treasure trove, thanks not least to the Roman army custom of laying down a clean cover of clay and turf over demolished structures before rebuilding. Why should this matter? Because this created anaerobic conditions in many areas, and the lack of oxygen has led to the survival of almost everything that was lost or discarded at the time. Among the booty is a vast range of leather

goods, textiles, wooden objects, bronze and iron objects, and, most famous of all, the Vindolanda tablets. The latter are slivers of wood, covered in spidery ink writing—the official and private correspondence of the men and women who lived at Vindolanda nearly 2,000 years ago.

However, that is not all that interests the archaeologists. Ongoing research by Jacqui Huntley, English Heritage NE Science Advisor, into the deep waterlogged deposits at Vindolanda is providing unique opportunities to understand the past environment of the area (Figure 12.14, Figure 12.15). This, in turn, has allowed her to shed new light on the realities of Roman military life. By microscopically examining samples taken from various deposits throughout Vindolanda, Huntley has been able to tease out information about the habitats represented at and around the site. Different plants typically grow together in specific environmental conditions—for example, very different plants grow in acidic wet marshes compared to dry neutral grasslands. Often, deposits can also give an insight on what the people were eating—yet Huntley found disappointingly low amounts of plant remains relating to human food at Vindolanda, unlike similar material from nearby Carlisle which was full of grape pips, fig pips, coriander and dill seeds, and even the occasional apricot (Hall and Huntley, 2007). Indeed, she soon noted that many of the Vindolanda deposits looked suspiciously like stable manure. She was spot on, and this has led her to focus on the horses at Vindolanda.

Figure 12.13 The Roman fort at Vindolanda. Source: Idelaink Photo/Alamy Stock Photo.

Contemporary accounts and archaeological evidence indicate that part infantry/part cavalry units with about 500 horses were stationed at Vindolanda. By investigating samples taken from throughout the site, Huntley gained a view of where and how these horses were cared for. Thus, in the *Praetorium*, the commandant's house, she identified where the commandant's horse slept and where its fodder was kept. Meanwhile, she noted that other samples, taken from ditches toward the edge of the fort, had bracken and seeds of plants from short grassland. This indicated that the animals were put out to graze during the day and brought back into the fort at night—when the dung was deposited (Huntley, 2007).

Taking the habitat information, osteological data about the size of the horses, the amounts of hay and grazing such horses need, plus hay yields from traditionally managed meadows, further allowed Huntley to calculate the approximate amounts of land needed to care for 500 horses: about 250 hectares of hay meadow, 200 hectares for grain production, 30–40 hectares of bracken at a minimum would be needed for bedding, and up to 400 hectares of grazing (though this would have varied seasonally and according to other factors). Even with a lot of caveats, the Romans would clearly have needed to control a huge amount of land for the military to function. Moreover, this would have been repeated all along the wall zone, where several forts were purely cavalry forts, meaning twice as many horses to maintain.

Never before has this field of study been investigated in such detail. The results have major repercussions for understanding the workings of the Roman military. Who would have thought that work on environmental data from murky horse dung would have shed such new light on the past?

Figure 12.14 Plant remains from Roman horse manure under the microscope at about x50—includes cereal periderm (skin), legume tendrils, and flower, moss stems, also a partial sedge nutlet.

Source: Photograph courtesy J. Huntley.

Back in 1944, a Danish botanist named Johannes Iverson noticed that pollen diagrams from Scandinavian bogs showed a dramatic falloff in forest cover at about the time when farmers first settled in northern Europe. Simultaneously, pollen counts for grasses of all kinds rose rapidly. He also found evidence for *P. lanceolata*, a little-known weed that grows on cultivated fields. Iverson's discovery produced confirmation of the changes wrought by forest clearance. Herds of grazing animals can also change the landscape dramatically. Goats, for example, are voracious feeders that can strip bushes and trees and tear out plants by their roots. Many archaeologists believe that the natural environment of southwestern Asia was stripped of much tree and natural grass cover by overgrazing a few centuries after animal domestication.

Other creatures, such as beetles can provide remarkably precise

information about the habitats in which they flourished. Many species feed off specific host plants, some of which grow as a result of human activity. There are, for example, distinct beetle forms associated with stored and decaying organic material such as human food or feces. When another British archaeologist, Francis Pryor (1991), discovered an artificial platform of 1350 B.C. in the middle of waterlogged Flag Fen in eastern England, he was anxious to determine if the jumble of ancient timbers in the midst of the water included actual dwellings. Biologist Mark Robinson took core samples from organic sediments adjacent to the platform and from sealed layers on the structure itself. The beetles from the side samples were predominantly those that flourished in marsh habitats and in stagnant water. Robinson also found the remains of dung beetles, which feed on cattle droppings. The same species came from the platform itself, but no insects that typically feed on damp thatch, old straw, stored grain, or foul matter such as settlement refuse were found. Robinson concluded that no active human settlements had been within 164 feet (50 m) of any of his samples. He also believes that the timbers became waterlogged rapidly because they contained almost no woodworm beetles, which feast off fresh, dry wood.

The most powerful reconstructions come from a combination of lines of evidence. A medieval town at Uppsala, Sweden, was burnt down in 1543, leaving a treasure trove of ecological data for archaeologists. A team of researchers studied the wood, mollusks, and plant remains, as well as the insects, which were among the most informative ecological finds. Magnus Hellqvist and Geoffrey Lemdahl identified 81 insect forms dating from the twelfth to fifteenth centuries; almost all of them were beetles found in a row of oak barrels. The beetles were varieties that flourished in moist habitats, open areas, and cultivated fields, suggesting that the settlement, mainly of farm buildings, lay in an open landscape. Several of the beetle forms were species that live in habitats in and around farm buildings, suggesting that towns such as Uppsala were more rural than urban. Some of the beetles do not occur as far north as Uppsala today, suggesting that summers were one or two degrees warmer than the 63°F (17°C) of modern times; the difference is not surprising, for the history of the town spans the end of the medieval warm period of A.D. 900–1300, as well as the subsequent Little Ice Age.

Summary

1. The study of long- and short-term climatic and environmental change is of vital importance to archaeologists concerned with human societies' changing relationships with their surroundings. This chapter described ways of studying such changes.
2. Geoarchaeology is a multidisciplinary approach to the study of human adaptations that reconstructs ancient landscapes using such approaches as remote sensing and paleogeographical and biological methods such as pollen analysis.
3. Deep-sea cores and ice drillings provide us with a broad framework of climatic change during the Pleistocene (Ice Age) Epoch that chronicles at least nine glacial periods during the past 730,000 years. The Pleistocene itself is divided into three broad subdivisions, the last of which coincides with the spread of modern humans across the world from Africa.
4. The Holocene covers postglacial times and has witnessed not only global warming but also at least three short periods of much colder conditions. The Younger Dryas brought drought and cold conditions and may have helped trigger the development of agriculture in southwestern Asia. The flooding of the Black Sea lake in approximately 5500 B.C. by saltwater from the Mediterranean may have caused major population movements in Europe.
5. Short-term El Niño events and drought cycles are studied with the aid of ice cores, geological observations, and tree rings—methods that are achieving increasing precision. We are now beginning to realize that short-term climatic change played a vital role in the rise and fall of many human societies.

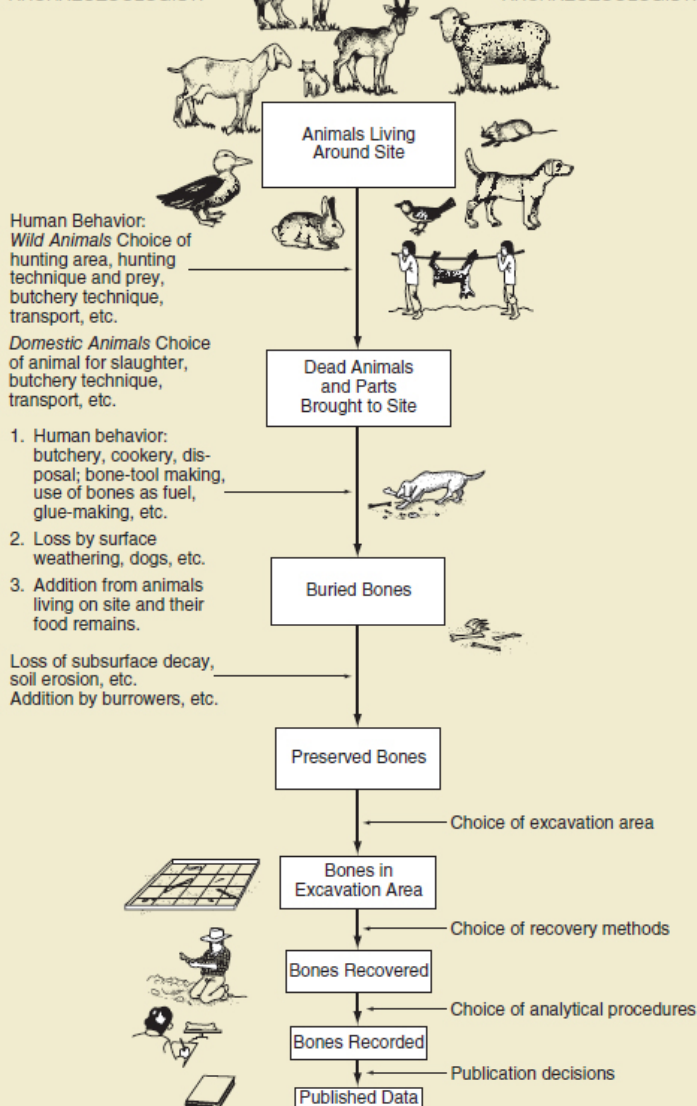
Further Reading

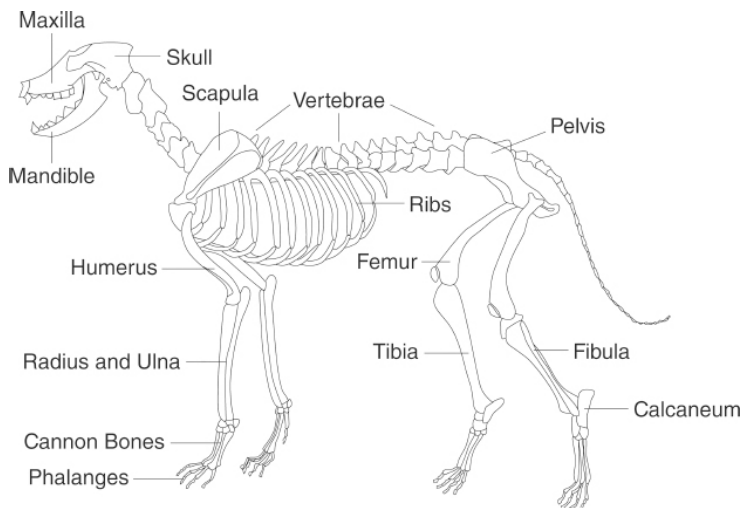
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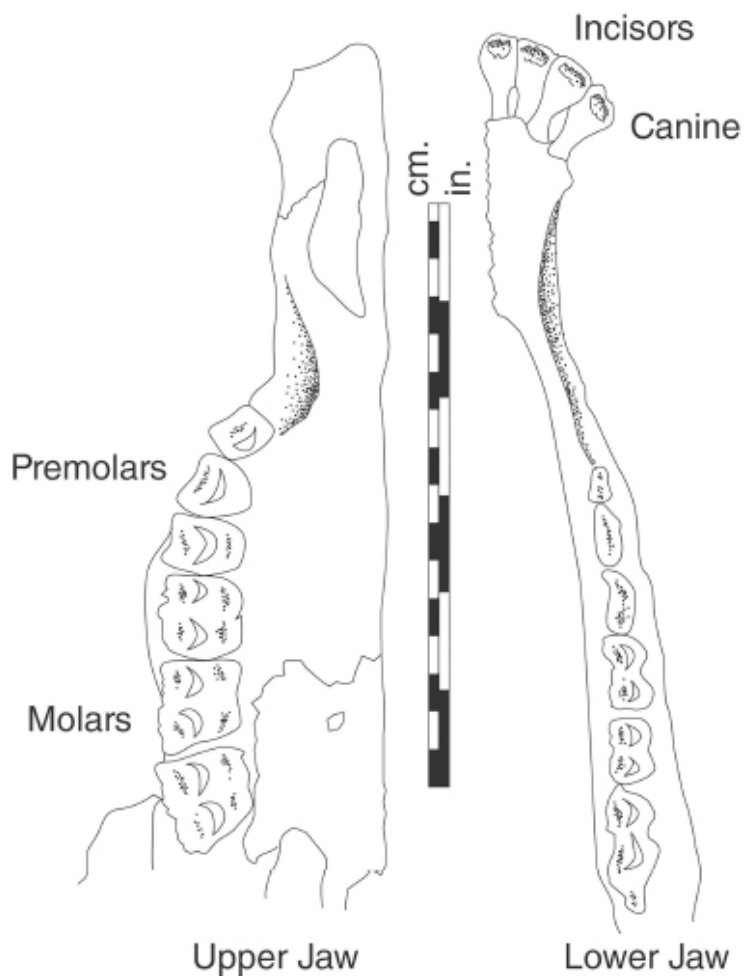


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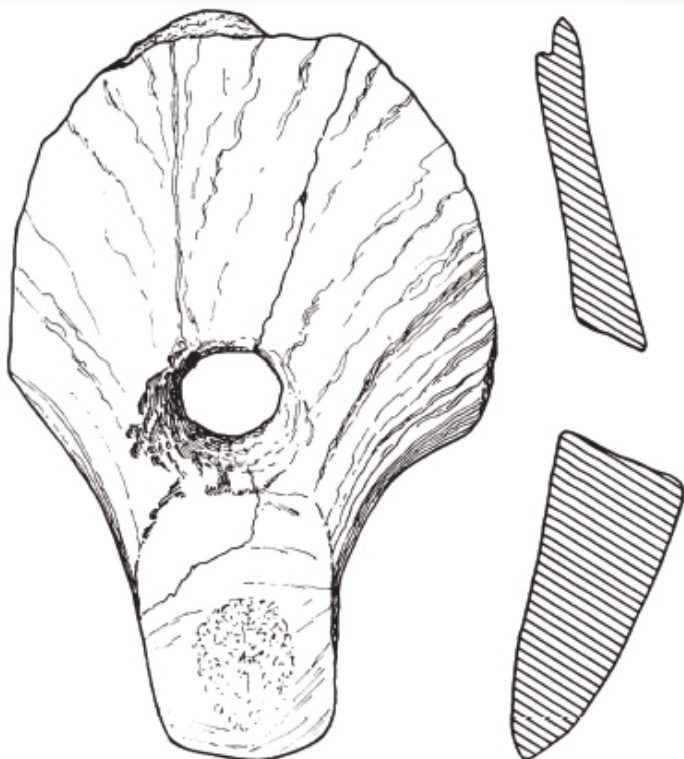
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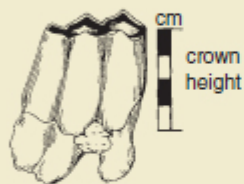
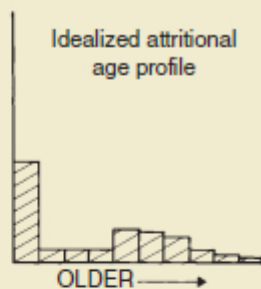
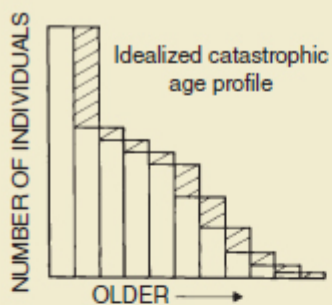




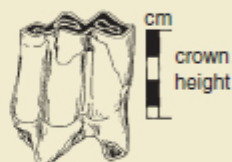
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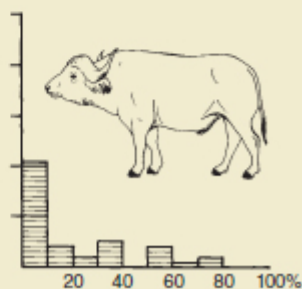
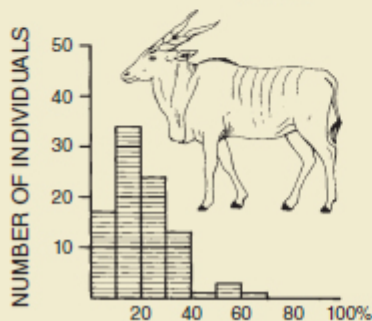
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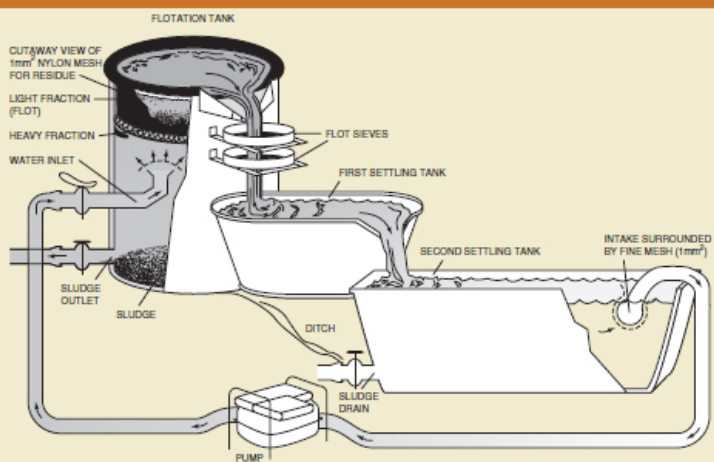
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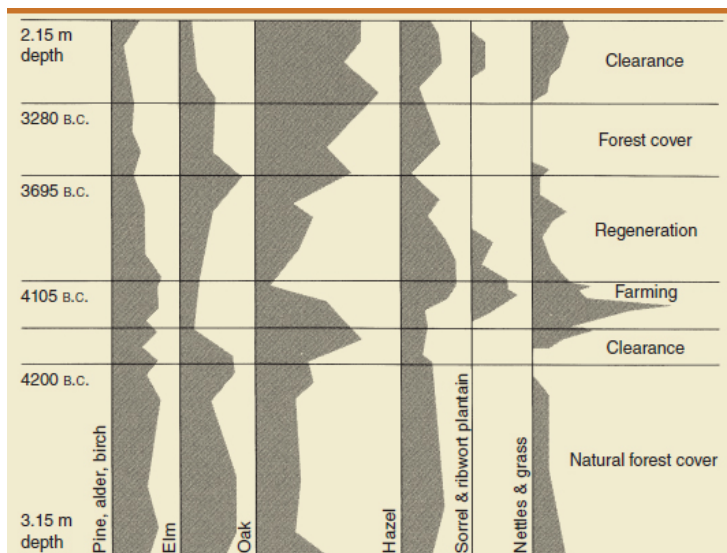


Cape Buffalo



PERCENTAGE OF LIFESPAN









13

Studying Subsistence

CHAPTER OUTLINE

Studying Subsistence

Animal Bones (Zooarchaeology)

Plant Remains

Bone Chemistry

Birds, Fish, and Mollusks

Subsistence Data from Rock Art

Ancient Diet

An Old Kingdom Egyptian servant grinds grain. Source: DeAgostini/Getty Images.

Take the forelimb of a deer, a handful of wild-grass seeds, a corncob, and a few grinding implements, study them closely in a laboratory, and come up with a reconstruction of the diet of the people who lived at the site where you found those few food remains. This is basically what archaeologists attempt to do when they study the subsistence practices of ancient societies.

We can boast of some remarkable progress in the study of ancient lifeways. We know, for example, that the earliest hominins scavenged meat from predator kills under the noses of lions and other formidable cats. Late Ice Age Cro-Magnon people of 20,000 years ago followed spring and fall reindeer migrations and butchered animals in their prime. In a remarkable piece of detective work, from the feces of infants recovered from small hearths, botanist Gordon Hillman was able to reconstruct the plant foods eaten by a group of foragers who lived at Wadi Kubbania on the banks of Egypt's Nile River in 16000 B.C. . They relied on at least 13 edible plants, most commonly wild-nut grass, which is still a staple for Egyptian villagers to this day (Hillman, 1989). Similarly, we know that some of Thomas Jefferson's slaves at Monticello, Virginia, ate better cuts of meat than some of the field servants. Food remains open unusual and often fascinating windows into the past, and tell us a great deal about social conditions and adaptations to changing environments. This chapter describes some of the methods archaeologists use to study ancient subsistence and diet.

Studying Subsistence

Archaeologists reconstruct ancient lifeways from the surviving material remains of subsistence activities, which come in many forms. As it is in every other form of archaeological research, the perspective is multidisciplinary, for we rely on the expertise of scientists from many other fields, among them botanists, ecologists, and zoologists.

- *Environmental Data.* Background data on the natural environment is essential for studying subsistence. The data can include information on such phenomena as climate, animal distributions, ancient and modern flora, and soils—the range of potential resources to be exploited (see [Chapter 12](#)).
- *Animal Bones (Faunal Remains).* These are a major source of information on hunting practices and domestic animals.
- *Plant Remains (Floral Remains).* Plant remains can include both wild and domestic species, obtained using flotation methods and from actual seeds found in dry sites or carbonized by fire.
- *Human Bones.* Bioarchaeology is a vital source of information. Stable carbon isotopes of skeletal collagen from human bones provide valuable information on ancient diets. Bones also give evidence of anatomical anomalies, ancient diseases, and dietary stress.
- *Artifacts.* The picture of human subsistence yielded by artifacts can be incomplete because of poor preservation, but implements such as plow blades can be useful sources of evidence.
- *Rock Art.* Occasionally, rock art depicts scenes of the chase, fishing, and food gathering, or indeed of people tending seemingly domesticated animals. This can provide useful information on subsistence activities.
- *Feces (Coprolites).* These yield vital evidence for reconstructing prehistoric diet in both animals and humans.
- *Bone Isotopic Chemistry.* This high-technology method provides detailed information on the diets consumed by ancient people, derived from their teeth.

Most reconstructions of ancient lifeways rely on evidence from several different sources. For instance, the excavators of the Wadi

Kubbaniya site found Nile catfish bones, the bones of gazelle (a desert antelope) and wild oxen, plant remains preserved in infant feces, and the bones of winter-migrating waterfowl. They painted a composite portrait of foragers who moved along the Nile in search of different seasonal foods 11,000 years before the pharaohs founded ancient Egyptian civilization (Hillman et al., 1989). As we saw earlier, archaeologists have long considered humans and their culture as merely one element in a complex ecosystem. The study of prehistoric subsistence, then, has developed hand in hand with attempts to understand the complex interrelationships between the way people make their living and their environment.

Animal Bones (Zooarchaeology)

The Old Testament prophet Ezekiel unwittingly defined the task of the zooarchaeologist: “And I prophesied as I was commanded; and as I prophesied, there was a noise, and behold, a rattling; and the bones came together, bone to its bone” (Ezekiel 37:10). Zooarchaeologists literally put the flesh on long-dead animals. **Zooarchaeology** is the study of animal bones found in the archaeological record. Its goal is to reconstruct the environment and behavior of ancient peoples as far as the animal remains allow. It is a specialized expertise that requires a background in paleontology or zoology. Although some zoologists specialize in the study of animal bones from archaeological sites, most zooarchaeologists have a background either in paleontology or in the study of prehistoric faunas (faunal analysis). (For general discussions, see Albarella and Rizzetto, 2017; Binford, 1981; O’Connor, 2000; and Reitz and Wing, 2008.)

Taphonomy

The word **taphonomy** (Greek *taphnos*, “tomb”; *nomos*, “law”) is used to describe the processes that operate on organic remains to form fossil deposits (Lyman, 1994; Shipman, 1981). Simply put, it is the study of the transition of animal remains from the biosphere to the lithosphere.

A fossil fauna goes through several stages as it passes from the biosphere into the hands of the archaeologist. The bones originally

come from what scientists call the **life assemblage**, the community of live animals in their natural proportions. The animals that are killed or die of natural causes become the **deposited assemblage**, the carcasses or portions of carcasses that come to rest in a site. The fossil assemblage consists of the animal parts that survive in a site until excavation or collection by a scientist. The **sample assemblage**—the part of the fossil assemblage that is actually excavated or collected—is what reaches the laboratory (Klein and Cruz-Uribe, 1984). Anyone carrying out faunal analysis must solve two problems: the statistical problem of estimating the characteristics of a fossil assemblage from a sample and the taphonomic problem of inferring the nature of the deposited assemblage from the fossil assemblage.

Taphonomy involves two related avenues of investigation. The first is actual observation of recently dead organic remains as they are transformed gradually into fossils; the other is the study of fossil remains in the light of this evidence. This field of investigation came into fashion during the 1960s and 1970s, when archaeologists became interested in the meaning of animal bone scatters at such early sites as Olduvai Gorge in East Africa, and especially in the celebrated *Australopithecus* caves of South Africa (Brain, 1981).

Many questions about the processes that transform living organisms into “archaeological” bones remain unanswered, despite some research into such topics as ways in which bones can be transported and disarticulated by both carnivores and natural agents, such as water. For example, experiments with captive hyenas have shown that they first choose backbones and hipbones, which they usually destroy completely. Limb bone ends are often hewed off, while shafts are often intact. These experiments are of importance because they tell us that the early hominin bone caches at Olduvai Gorge were picked over by hyenas after their human owners had abandoned them, a process that led to the destruction of many body parts, thereby making it impossible to tell whether the hominins had selectively transported some parts of animal kill and not others (Marean et al., 1992). Humans disarticulate animals with tools long before the carcasses are dispersed by natural phenomena or by carnivores; therefore, their systematic activities are at least a baseline for examining patterns of damage on archaeological bones. Interpretation of prehistoric living floors and kill sites has to be

undertaken with great care, for the apparent patterns of bones and artifacts on such a prehistoric land surface represent not only human activity but also complex and little-understood natural processes.

Discovery A Temple Built by Hunter-Gatherers? Göbekli Tepe, Turkey, 1994–

Göbekli Tepe in Southeastern Turkey is an astounding site that has opened a window onto the ritual life of early postglacial people in Western Asia. It consists of at least 20 circular enclosures containing massive, exuberantly decorated T-shaped pillars, and was constructed more than 11,000 years ago. The site has been dubbed the oldest temple in the world—and by a vast time span—previously, the accolade went to the fourth millennium B.C. megalithic sanctuaries on Malta. What makes this site yet more intriguing is that, given its very early date, it may not have been built by (fully) settled cultivators, as would normally be assumed of sites with large standing architecture. This argument, if correct, challenges conventional wisdom about early Neolithic socioeconomic developments.

Sitting high atop a hill overlooking the surrounding plains, Göbekli Tepe (the name means “belly hill” in Turkish) is a conspicuous site some 984 feet (300 m) in diameter. In the 1960s, archaeologists dismissed it as a medieval, and there the story might have ended had it not been for archaeologist Klaus Schmidt of the German Archaeological Institute in Berlin. When Schmidt first examined the site in 1994, he noted stone artifacts scattered on the surface, which led him to suspect that the site actually dated to the very earliest centuries of agriculture, or around 9600 B.C. Subsequent, if limited, radiocarbon dating at the site confirms this assessment. However, not even Schmidt could have anticipated what lay beneath the soil.

From 1996 until his death in 2014, his excavations uncovered a series of unique and evocative shrines complete with large decorated pillars, which Schmidt called megaliths. The limestone came from nearby quarries. Many of the pillars bear pairs of arms and hands in low relief, as if they were stylized depictions of people, the horizontal part of the T representing the head (see [Figure 13.1](#)).

Some have carvings of lions, foxes, wild boars and oxen, even birds,

spiders, and insects. The pillars themselves formed circular or oval enclosures, as many as 12 of them separated by stone benches. Two pillars of the finest quality and greater size lay in the center of each enclosure. Fortunately for Schmidt, later farmers dumped refuse into the enclosures and buried them before they could be disturbed. Schmidt excavated six, but he also mapped the entire summit using ground-penetrating radar and geomagnetic surveys—and identified at least 20 rings at the site, containing more than 200 pillars, and buried across 22 acres. His one-acre excavation area covered less than 5 percent of the site.

What do we make of this site? The notion that this is a temple, or at the very least a sacred site, comes partly from the unusual structures but also partly from the fact that there are no real signs that it was ever an inhabited settlement in the usual sense—there are no dwellings, courtyards, domestic equipment, nor any hearths. On the other hand, one might question whether its “shrines” were purely for ritual activity, or whether people lived in them as well but cleaned out their refuse. The same issue arises at other sites, including Çatalhöyük, a later village (or even small town) several hundred miles to the west where people lived in structures surrounded by equally “exotic” “ritual” art (see [Chapter 3](#)). But whatever its true purpose—or purposes—this is clearly a very unusual site. Yet there is something even more perplexing about the site.

Figure 13.1 Göbekli Tepe, Turkey. (*Left*) A large subterranean building showing T-shaped monoliths and two others embedded in dry stone walls at the edge of the building, where a bench lies. (*Right*) A T-shaped monolith from the site, with low-relief sculpture of a wild ox, a fox, and a crane.

Source: Courtesy of National Geographic Image Collection/Alamy Stock Photo.

Copious fragments of animal bones were found at Göbekli, but all apparently come from wild animals, such as wild gazelle, boar, sheep and red deer plus a dozen different bird species, including vultures, cranes, ducks, and geese. Of the over 100,000 bones analyzed so far, many have butchering marks or signs of food preparation. Thus, although the site seems to date from the very early days of agriculture, its builders were clearly still heavily involved in hunting. Schmidt

therefore suggested that the site was likely the work of hunter-gatherers, an argument that remains contrary to all established wisdom about the early Neolithic.

It is normally understood that, only long after people had settled down and learned to farm, did they have the time, organization, or resources to support complicated social structures. Whereas Klaus Schmidt argued the opposite: That (at Göbekli Tepe, at least) it was the extensive, coordinated effort expended to construct monumental buildings that laid the groundwork for the development of complex societies. So did Göbekli Tepe actually play a critical role in the transition from hunting to agriculture? Schmidt believed so. However, he did not envisage little disorganized bands of hunter-gatherers—rather to carve, erect, and bury rings of megalithic stone pillars (some weigh 12 tons) would have required hundreds of workers, all needing to be fed and housed. One logical way to do this would, therefore, have been to increase the supply of wild plant foods by sowing them to supplement the food supply. Thus he suggested that the necessary social organization required to build the shrines was directly linked to the organized exploitation of wild crops. This would then have led to deliberate cultivation. And so, according to Schmidt, began the process of domestication.

Interestingly, the world's oldest-known domesticated einkorn wheat, dating to 9400 cal B.C., was identified at Sanliurfa Yeni-Mahalle, some 9.3 miles (15 km) southwest of the site (Haldorsen et al., 2011). While other early—but not as early—domesticated wheat has been found at other nearby sites. Once the people had begun sowing seeds, it seems they then applied their new way of living to animals, since research at other sites in the region has shown that within a millennium of Göbekli Tepe's construction, settlers had corralled sheep, cattle, and pigs.

But if these structures were built by hunter-gatherers then what was their motivation? This spot, overlooking the plains, would have been seen for miles around. Was Göbekli the work of hard-pressed hunter-gatherers, who were marking their territory in the wake of environmental pressures? And if they were shrines then were they built to placate their gods? The site dates from the early Holocene—temperatures had recently warmed up. One theory, voiced by Çelik (pers. comm) is that it had been on a productive migration trail of

game, but that the animals had begun to change their millennia-long route, moved elsewhere, or declined in number. Was the temple a bid to the gods to protect their food source—the wild animals whose butchered bones lie nearby? Yet if that were the case, why are the site's pillars dominated not by edible prey, such as deer and cattle, but by menacing creatures such as lions, spiders, snakes, and scorpions? Perhaps the hunters were trying to master their fears in a changing world.

For Schmidt, a key function of the site was as the main ritual center for the inhabitants of nearby settlement sites, such as Nevali Cori (which he also excavated and also contains T-shaped carved megaliths). He suggested that they probably visited Göbekli Tepe on a seasonal basis, when they quarried and carved megaliths and erected them in sacred enclosures.

He also believed that the enclosures were built not for the living but for the dead. Schmidt speculated that it was only a matter of time before human remains would be discovered, believing that Göbekli probably represents a final resting place for a society of hunters. He even wondered if it were some sort of center for a death cult, perhaps a place where the dead would be laid out on the hillside among the stylized gods and spirits of the afterlife (Bachenheimer, 2018). Although formal human burials are still unknown from Göbekli, excavations have proven Schmidt's hunch right, and the current team has uncovered almost 700 human bone fragments, including 40 fragments of skull, and three partially preserved crania. The three human crania have unusual evidence for cut marks, which may point to special ritual behavior (perhaps, say the researchers, even some form of local and previously undocumented "skull cult").

After about 8000 B.C., it seems that the site was abandoned and purposely covered over with soil—perhaps, as Schmidt suggested, with the so-called Neolithic Revolution, the invention of crop agriculture, and animal domestication, the old religious world of the hunters became worthless and the site was abandoned. Whatever the motives behind Göbekli's construction, or abandonment, this site offers a new way of interpreting the domestication of plants and animals in the Near East. If correct, then Göbekli Tepe turns on its head the conventional notion that major building projects only happened long after

agriculture had taken root—suddenly, we see how an organized building project could have preceded, if not precipitated, domesticated agriculture.

However, work is still ongoing. Just as Schmidt expected further excavation would reveal human remains, so future analysis and further excavation may still come to show that the people who originally built Göbekli Tepe were also engaged in at least some cultivation. Perhaps this would not be surprising given the extensive communal works required to construct such major structures, and given the fact that the site dates to the early centuries of agriculture. This is an exciting and rich site, so watch this space for future developments, interpretations and reinterpretations.

Many zooarchaeologists worry that interpretations of bone assemblages from archaeological sites will never reconstruct the actual living population environment. However, Klein and Cruz-Uribe (1984) believe that viable paleoecological reconstructions can be made when several fossil assemblages can be compared using statistical measures, provided that both the quality of bone preservation and the sedimentary conditions of the bones at the study locations are similar. Each situation must be assessed with great care.

Figure 13.2 Analysis of bones from the archaeological record: This figure shows some of the factors that affect the data. Factors that the archaeologist cannot control are on the *left*; those that the archaeologist can control are on the *right*.

Source: Adapted from Simon J. M. Davis, *The Archaeology of Animals*. London: Batsford, 1987.

Sorting and Identification

Animal remains are usually fragmentary, coming from dismembered carcasses butchered either at the archaeological site or at the hunting grounds. To some degree, how much of the carcass is carried back to camp depends on the animal's size. Small deer may be taken back whole, slung from the shoulder. Hunter-gatherers sometimes camped at the site of the kill of a large animal, where they ate parts of the carcass and dried parts for later use. Almost invariably, however, the bones found in occupation sites have been broken into splinters. Every piece of usable meat was stripped from the bones; sinews were made into

thongs, and the skin was formed into clothing, containers, or sometimes housing. Even the entrails were eaten. Limb bones were split for their marrow; some bones were made into tools such as harpoon heads, arrow tips, and mattocks ([Figure 13.2](#)).

It would be a mistake to assume that the fragmentary bones found in an archaeological deposit will give an accurate count of the number of animals killed by the inhabitants or accurate insights into the environment at the time of occupation (Grayson, 1984). The fragmentary bones found in an archaeological deposit have been subjected to many diverse processes since their deposition. Taphonomic processes often result in major changes in buried bone, perhaps even destroying the bones of smaller animals, though not of larger ones. Then there are human factors: People may carry in some game from far away yet kill all of their goats at the village. We have no way of knowing what spiritual role some animals possessed in ancient societies, or what taboos and other prohibitions may have caused certain animals to be hunted and others to be ignored. Nor, as we have already pointed out, have we any means of knowing precisely what the relative frequencies of different animal species were in the prehistoric environment. Certainly, researchers cannot use animal bones from archaeological sites for this purpose. The difference between what one might call the “actual animal” and the “archaeological animal” identified by the archaeologist is always unknown. The archaeological animal consists of a scattering of broken bones that have been shattered by a butcher and then subjected to hundreds or thousands of years of gradual deterioration in the soil.

Most bone identification is done by direct comparison with bones of known species. It is fairly simple and easily learned by anyone with sharp eyes. But only a small proportion of the bones in a collection is complete enough for this purpose. The drawing of a dog in [Figure 13.3](#) illustrates a typical mammalian skeleton. Small skull fragments, vertebrae, ribs, scapulae, and pelvic bones are normally of little use in differentiating a domestic animal from a wild one or one species of antelope from another. Upper and lower jaws and their dentition, individual teeth, the bony cores of horns, and sometimes the articular surfaces of long bones are easy to identify. Teeth are identified by comparing the cusp patterns on their surfaces with those of

comparative collections carefully taken from the site area (see [Figure 13.4](#) on page 250).

In some parts of the world, the articular ends of long bones can be used as well, especially in southwestern Asia or parts of North America, where the indigenous mammalian fauna is somewhat restricted. It is even possible to distinguish the fragmentary long bones of domestic stock from those of wild animals of the same size in southwestern Asia, provided the collections are large enough and the comparative material is sufficiently complete and representative of all ages of individuals and of variations in size from male to female. But in other areas, such as sub-Saharan Africa, the indigenous fauna is so rich and varied and has such small variations in skeletal anatomy that only horn cores or teeth can help distinguish among species of antelope and separate domestic stock from game animals. Even the dentition is confusing, for the cusp patterns of buffalo and domestic cattle are remarkably similar, often distinguishable only by the smaller size of the latter. Experts disagree as to what constitutes identifiability of bone, so it is best to think in terms of levels of identifiability rather than simply to reject many fragments out of hand. For example, you can sometimes identify a fragment as having come from a medium-sized carnivore, even if you have no way of telling that it is from a wolf.

The identification stage of a bone analysis is the most important, for several fundamental questions need answering: Are domestic and wild species present? If they are, what are the proportions of each group? What types of domestic stock did the inhabitants keep? Did they have any hunting preferences that are reflected in the proportions of game animals found in the occupation levels? Are any wild species normally associated with vegetation unknown in the area today?

[Figure 13.3](#) The skeleton of a dog, showing the most important body parts from the osteological viewpoint.

[Figure 13.4](#) The skull and jaw of a domestic ox, showing important osteological features. (One-fourth actual size.)

Comparing Bone Assemblages

Zooarchaeologists Richard Klein and Kathryn Cruz-Urbe (1984) and

others (Marshall and Pilgram, 1993) describe measures of taxonomic abundance for assessing whether differences between assemblages are real, or the result of biased collecting or other factors. They also use the same measures to make estimates of the relative abundance of different species. The **number of identified specimens (NISP)** is a count of the number of bones or bone fragments from each species in a bone sample. This measure has obvious disadvantages, especially since it can overemphasize the importance of one species that has more bones than another or has carcasses that were butchered more thoroughly than those of other species. Human activities such as butchering, and natural processes such as weathering can affect the NISP. The NISP does have a certain value, however, especially when used in conjunction with an estimate of the minimum number of individuals from which the identified bones have come. The **minimum number of individuals (MNI)** is a count of the number of individuals necessary to account for all the identifiable bones. This count is smaller than the NISP and is often based on careful counts of such individual body parts as heel bones. The MNI overcomes many limitations of the NISP because it is a more accurate estimate of the actual number of animals present. However, everything depends on the experts' using the same method of calculating the MNI—which they often do not (Grayson, 1984).

The NISP and MNI together permit us to estimate the number of animals present in a bone sample, but they are highly imperfect ways of measuring abundance of animals in an archaeological sample, let alone of providing a means for relating the bone materials to a living animal population in the past. Klein and Cruz-Urbe, among others, have developed sophisticated computer programs to overcome some of the limitations of NISP and MNI, programs that lay out the basic information that is vital for intersample comparisons.

Another approach focuses on the minimum number of skeletal elements (MNE) as a way of measuring the degree of skeletal completeness for each identified animal. This uses skeletal parts rather than individuals as the unit of measurement (Lyman, 2005).

Species Abundance and Culture Change

Climatic rather than culture change was probably responsible for most

long-term shifts in animal-species abundance in the Ice Age. Some shifts must reflect human activity, changes in the way in which people exploited other animals (Bovin et al., 2016). These changes, however, are very difficult to distinguish from environmental changes. One of the few places where it has been possible to document such shifts is in South Africa.

There, zooarchaeologist Richard Klein has tackled the problem of species abundance and culture change by studying large faunal samples from two coastal caves in the Cape Province of South Africa. The Klasies River cave was occupied by Middle Stone Age hunter-gatherers between about 130,000 and 95,000 years ago, during a period of warmer climate, and thereafter until about 70,000 years ago, when the weather had become much cooler. The seashore was close to the cave during the earlier, warmer millennia. Numerous mollusks, seal bones, and penguin remains tell us much about Middle Stone Age diet in the cave. Seabird and fish remains are rare. The remains of eland, a large antelope, are the most common large mammal remains, more than twice as common as those of the Cape buffalo. The rest of the land mammal remains are of species common in the area during modern historic times. In contrast, the nearby Nelson's Bay cave contains evidence of later Stone Age occupation dating to after 20,000 years ago—much of it at a time when the sea was some miles from the cave—during the coldest part of the last Ice Age glaciation. Bones of flying seabirds and fish are abundant in this cave, and those of eland are only a third as common as those of buffalo.

Klein points out that tool kits are quite different in the two caves. The Middle Stone Age people of the Klasies River cave used large flake tools and spears. In contrast, the later Nelson's Bay hunters had bows, arrows, and a rich tool kit of small stone tools and bone artifacts, many of them for specialized purposes, such as fowling and fishing. These innovations allowed Late Stone Age hunters to kill dangerous or more elusive species with greater frequency. Thus, the reason that the Middle Stone Age people took more eland was not that eland were more abundant in earlier times, but that more elusive creatures, such as birds and fish, were captured less frequently. There is every indication that the Klasies people were less advanced behaviorally than the Nelson's Bay people (Klein and Cruz-Uribe, 1984).

Game Animals

Though the listing of game animals and their habits gives an insight into hunting practices, in many cases the content of the faunal list gains particular significance when we seek to explain why the hunters concentrated on certain species and apparently ignored others.

Taboos Dominance by one game species can result from economic necessity or convenience, or it can simply be a matter of cultural preference. Many societies restrict hunting of particular animals or consumption of certain game meat to one or the other sex. The modern-day !Kung San of the Dobe area of Botswana have complicated personal and age- and sex-specific taboos against eating mammals (Lee, 1979). No one can eat all 29 game animals regularly taken by the San, and no two individuals have the same set of taboos. Some mammals can be eaten by everyone, but with restrictions on which part they may eat. Ritual curers will set personal dietary restrictions on certain animals; no one eats primates and certain carnivores. Such complicated taboos are repeated with innumerable variations in other hunter-gatherer and agricultural societies and have undoubtedly affected the proportions of game animals found in archaeological sites.

Examples of specialized hunting are common from ancient times, even if the reasons for the attention given to one or more species are rarely explained. The specialized big-game hunting economies of the Plains Indians are well known (Kornfeld et al., 2009). Another factor is overhunting, or the gradual extinction of a favorite species. One well-known example is *Bos primigenius*, the European aurochs or wild ox, which was a major quarry of Upper Paleolithic hunters in western Europe and was still hunted in postglacial times and after food production began (Kurtén, 1968). The last aurochs died in a Polish park in 1627. We know from illustrations and descriptions what these massive animals looked like. The bulls were large, up to 6 feet (2 m) at the shoulder, and often had very long horns. The male's coat was black with a white stripe along the back and white curly hair between the horns. Through careful, long-term breeding and selecting for the physical features of the aurochs, German and Polish biologists have "reconstituted" these beasts successfully (see [Figure 13.5](#)). Reconstituted aurochs are fierce, temperamental, and extremely agile if allowed to run

wild. The experiments have provided a far more convincing reconstruction of a most formidable Pleistocene mammal than could any number of skeletal reconstructions or artists' impressions.

Figure 13.5 The aurochs, reconstituted through modern breeding experiments.

Source: Courtesy of imageBROKER/Alamy Stock Photo.

Changes in Hunting Activities Hunting activities have changed drastically in recent times. Richard Lee (1979) records how the older members of the San say that in earlier times there were more game animals and more hunters in the central interior of Botswana. Their forefathers used to hunt in large groups, killing buffaloes, giraffes, and elephants. Today, their descendants have a predominantly gathering economy, supplemented by the meat of 29 mammals, mostly those whose carcasses have a relatively high meat yield. Hunting is a common pursuit, with the warthog being the most important source of meat, together with small game. This change in hunting habits results directly from the importation of rifles and from early hunting safaris, which decimated the wonderful African fauna within three generations.

Seasonal Occupation Many prehistoric hunter-gatherers and farmers, like their modern counterparts, lived their lives in regular, seasonal cycles in which subsistence activities changed according to the seasons of the year. The Pacific Northwest Indians congregated near salmon rivers when the summer runs upstream took place. They would catch thousands of salmon and dry them for consumption during the winter. The early dry season in Central Africa brings into season an abundance of wild fruit, an important part of the early farmers' diet 1,500 years ago. A notable example of seasonal occupation comes from the Star Carr in northeastern England, occupied in about 8500 B.C. (see the Doing Archaeology box).

Every aspect of ancient hunter-gatherer life was affected by seasonal movements. The Northwest Indians enjoyed a complex ceremonial life during the sedentary winter months. The settlement pattern of the Khoekhoe pastoralists of the Cape of Good Hope changed radically between dry and wet seasons (Elphick, 1977). During the dry months, they would congregate at the few permanent water holes and near

perennial rivers. When the rains came, the cattle herders spread out over the neighboring arid lands, watering their herds in the standing waters left by rainstorms. How do archaeologists study seasonality? A variety of approaches have been used with some success. The simplest method uses bones or plant remains to establish the season a site was visited. For example, bird bones were used to establish that a 1,000-year-old San Francisco Bay site was visited each year about June 28, when cormorants were young (Howard, 1929). (See the discussion on birds later in the chapter.) The presence of cod bones in early Norwegian fishing sites indicates that they were occupied during the winter and early spring—the optimal time for drying fish. This type of analysis is fine, provided that the habits of the animals or the availability of the plants being examined are well known or have not changed through time. Some plants are available for much of the year but are edible only during a few short weeks.

Knowledge about the ecology of both animals and plants is essential, for the “scheduling” of resource exploitation, though perhaps not explicit, was certainly a major factor in ancient societies (see the Doing Archaeology box on page 253). Some species such as deer are relatively insensitive to seasonal changes, but people sometimes exploited them in different ways at different times of the year. For instance, the Coast Salish of the Pacific Northwest took bucks in the spring and does in the fall.

Doing Archaeology Environment and Seasonality at Star Carr, England

The Star Carr site in northeastern England was occupied by a small band of Stone Age hunter-gatherers in about 8500 B.C. This tiny settlement, with its well-preserved and rare bone and wooden artifacts, excavated half a century ago, is world famous for its remarkably complete portrait of Stone Age life in northern Europe immediately after the last Ice Age. Between 1949 and 1951, Cambridge University archaeologist Grahame Clark (1954) excavated a tiny birchwood platform crammed with stone tool fragments, bone and wooden artifacts, and a wealth of food remains. Using carefully recorded artifact counts, animal bones, pollen analysis, and all manner of

esoteric identifications, as well as a liberal dose of traditional European folklore, Clark reconstructed a small hunting camp set in a patch of reeds by a lake. Pollen samples placed Star Carr to a time when birch forests first spread into northern Britain and much of the southern North Sea was still dry land. Clark and his experts argued that the red deer antlers indicated that the site was occupied in winter. Clark analyzed the methods used to make bone spearpoints, linked the technology of the stone tools to those made in Scandinavia at the time, and described a remarkable series of bone and wooden tools, including elk antler mattock heads (one with the tip of its wooden handle still in place), a single wooden canoe paddle, awls, and even bark rolls and lumps of moss used for lighting fires (see [Figure 13.6a](#)).

Star Carr has become an important testing ground for new ideas about ancient hunter-gatherer societies over the past half-century ([Figure 13.6b](#)). Archaeologists Paul Mellars and Petra Dark (1999) undertook 12 years of highly selective paleoecological and archaeological investigations at the site, using all the resources of modern science to reinterpret the site.

When Clark originally excavated Star Carr, he concentrated on a small waterlogged area in a gully. After three seasons, he interpreted the site as a small settlement, perhaps used irregularly by four or five families. The new excavations extended onto drier areas and showed that the site was of far greater extent than Clark had suspected. By fieldwalking and careful test pitting, the excavators plotted flint artifact scatters over more than 400 feet (122 m) of the ancient lake shore. Therefore, Star Carr saw much more widespread activity than Clark had originally suspected. By carefully surveying the original topography of the site, Mellars, Dark, and their colleagues located a clay-filled channel that once flowed through the center of the site, separating Clark's wetland area from the drier locations.

Clark had claimed that the inhabitants of Star Carr had had little impact on their surroundings. Dark was able to use much higher resolution microscopes to examine the distribution of charcoal particles associated with a new array of accelerator mass spectrometry (AMS) radiocarbon dates, and she showed that there was an initial period of intense charcoal deposition that lasted for about 80 years, then a century with little activity, followed by fairly continuous distribution

for another 130 years. Botanist Jon Hather identified the charcoals as lakeside reeds, burnt off when they were dry between autumn and spring, when the new growth begins. Mellars and Dark believe that the reeds were fired repeatedly by humans, largely because the samples of high charcoal frequency are localized at the site, as if burning had been tightly controlled. Such conflagrations could have provided people with a better view of the lake and surrounding terrain, as well as a convenient landing place for canoes, and could have fostered new plant growth, which would attract feeding animals.

Figure 13.6 (a) An elk antler mattock from Star Carr, England. (Two-thirds actual size.) (b) Excavations at Star Carr, 2008.

Source: Photo by Ben Gourley, University of York.

Clark's original report described Star Carr as a winter settlement, but now X-ray analysis of unerupted teeth deep in deer jawbones and comparisons with modern samples have identified many 10- to 11-month-old animals, which would have been killed in March or April (Carter, 1998). The new seasonality data agree with minute finds of tightly rolled leaf stems of reeds burnt in early growth between March and April and with aspen bud scales, which date to the same time of year. Star Carr may have been occupied from March until at least June or early July but with no winter settlement.

Then there are physiological events in an animal's life that an archaeologist can use to establish seasonal occupation. During the fifteenth century A.D., a group of Plains hunters regularly took bison near a water hole at Garnsey, New Mexico (Speth, 1983). John Speth analyzed the body parts at the kill site and discovered that the hunters had a strong preference for male beasts during the spring, the season at which the hunts took place. The butchers had abandoned at the kill site body parts with a low meat yield, such as skulls and upper neck bones. In contrast, bones that yielded a great deal of meat, marrow, or grease were underrepresented at Garnsey. Many more high-utility bones were taken from males than from females. Speth believes that the hunters concentrated on males because their meat had a higher fat content, and they were in better condition than females after the winter.

Growth patterns in animal bones can sometimes yield clues to

seasonal occupation. The epiphyses at the ends of limb bones are slowly joined to the main bones by ossification as an animal ages. Their study can certainly give some clues as to the general age of an animal population in, say, a hunting camp; but such variables as nutrition, or even castration in domesticated animals, can affect the rate of fusion. Some species, such as ducks, mature much faster than others, such as deer. Clearly, knowledge of the different ages at which epiphyses fuse is essential to this approach.

Everyone knows that teeth erupt from upper and lower jaws as people grow into adulthood, often causing problems with wisdom teeth. Teeth are such durable animal remains that many archaeologists have tried to use them to age game and domestic animal populations. It is easy enough to study tooth eruption from complete or even fragmentary upper and lower jaws, and it has been done with domesticated sheep, goats, and wild deer. Again, factors of nutrition, even domestication, can affect eruption rates, and the rate at which teeth wear can vary dramatically between one population and another.

Interpretation of seasonal occupation depends heavily on ethnographic analogies. One classic example is that of wild wheat. Botanist Gordon Hillman has studied the gathering of wild wheat in southwestern Asia and has shown that the collectors must schedule their collecting activities very precisely if they are to gather the harvest before the ears fall off the stems or the grain is consumed by birds and other animals (Hillman and Davis, 1990). It is reasonable to assume that the same precise scheduling was essential during prehistoric times, an analogy that has enabled southwestern Asian archaeologists to interpret seasonal occupations on sites in Syria and elsewhere.

By studying not only large mammals and obvious plant remains but also tiny mollusks and even fish bones and fish scales, one may be able to narrow the window of seasonal occupation at many sites to surprisingly tight limits.

Domestic Animals

Nearly all domestic animals originated from a wild species with an inclination to be sociable, facilitating an association with humans (Clutton-Brock, 1989). Domestic animals did not all originate in the

same part of the world; they were domesticated in their natural area of distribution in the wild. Scholars have assumed that domestication of wild animals takes place when a certain level of cultural achievement is reached. Domestication everywhere seems to begin when a growing population needs a more regular food supply to feed larger groups of people; domestication is dependent on such conditions and is a prerequisite for further population growth.

Wild animals lack many characteristics that are valuable in their domestic counterparts: Wild sheep have hairy coats but their wool is not the type produced by domestic sheep, which is suitable for spinning; aurochs, ancestors of the domestic ox, and wild goats produce sufficient milk for their young but not in the quantities important to humans. Considerable changes have taken place during domestication, as people developed characteristics in their animals that often rendered them unfit for survival in the wild.

The history of domestic species is based on fragmentary animal bones found in the deposits of innumerable caves, rock shelters, and open sites (Clutton-Brock, 1989). Osteological studies of wild and domesticated animals are inhibited both by fragmentation of the bones in most sites and by the much greater range of sexual and growth variation in domestic populations than in wild ones (Zeder and Hesse, 2000; Zeder et al., 2006). Nevertheless, a number of sites have produced evidence of gradual osteological change toward domesticated animals. If the bones of the wild species of some prehistoric domesticated animals are compared with those of the domestic animals throughout time, the range of size variations first increases, and eventually selection in favor of smaller animals and less variation in size appears. This transition is fluid, however, it is difficult to identify wild or domestic individuals from single bones or small collections.

The bones of domestic animals demonstrate that a high degree of adaptability is inherent in wild animals. People have found it necessary to change the size and qualities of animals according to their needs, with corresponding effects on the animals' skeletal remains. Different breeds of cattle, sheep, and other domestic animals have been developed since the beginning of domestication.

Slaughtering and Butchery

Some insights into human exploitation of wild and domestic animals can be obtained by studying animal bones, their frequency, and distribution in the ground.

Sex, Age, and Slaughter Patterns Clearly, determining the sex of an animal and the age at which it was killed may provide a way of studying the hunting or stock-raising habits of the people who did the slaughtering. Archaeologists have used a variety of methods for establishing sex and age from fragmentary bones.

Males and females of many mammal species vary considerably in size and build. For example, male horses have canine teeth but females usually lack them. In humans, the female pelvis is very different from that of the male, in order to accommodate childbirth. We can estimate the proportions of males and females in sites, such as the Garnsey bison kill by comparing the ratio of male to female body parts; in this case the differences between male and female beasts are known. Such analyses are much harder when less is known about size differences, or when bones are very fragmentary. Zooarchaeologists use a variety of bone measurements to distinguish sex, but such approaches are fraught with statistical and practical difficulties; they work best on complete bones. Even then, it may only be possible to identify different measurement distributions that may or may not reflect differences between the sexes.

How old were these cattle when they were slaughtered? Did the inhabitants concentrate on immature wild goats rather than on fully grown ones? These are the kinds of questions that are of importance on many sites. To answer them, researchers must establish the age of the animals in the faunal sample at death. The skeletal parts most commonly used to determine the age of an animal at death are teeth and the epiphyses at the ends of limb bones. In almost all mammals, bones where the epiphyses are not fused come from younger animals. This fact enables us to construct two age classes: immature and fully grown. If we know the ages at which epiphyses fuse, as is sometimes the case in species such as domestic cattle, we can add additional classes. Unfortunately, epiphyseal fusing is too inaccurate a method to provide the kind of data that archaeologists need.

Figure 13.7 Idealized mortality data from modern animal populations based on molar crowns of two common South African mammals, the eland and the Cape

buffalo: (*left column*) idealized catastrophic age profile; (*right column*) idealized attritional age profile.

Fortunately, teeth and upper or lower jaws provide a more accurate way of establishing animal age. Teeth provide an almost continuous guide to the age of an individual from birth to old age. Complete upper and lower jaws allow us to study immature and mature teeth as they erupt, so we can identify the proportion not only of young animals but also of very old animals.

Individual teeth can also be a mine of information on animal age. Some biologists are using growth rings on teeth, but this method is still highly experimental. A far more promising approach measures the height of tooth crowns. Richard Klein, an expert on African bones, has measured crown heights on Stone Age mammal teeth found at the Klasies River and Nelson's Bay caves in the Cape Province of South Africa. Taken as two groups, the teeth measurements give interesting general impressions of the hunting habits of Middle and Late Stone Age peoples in this area (Klein, 1977). Klein compared the mortality distributions from the Cape buffalo and other large- and medium-sized species with mortality curves from modern mammal populations. He identified two basic distributions for the Stone Age bones (Klein and Cruz-Uribe, 1983). The **catastrophic age profile** has fewer older individuals. It is the normal distribution for living ungulate populations (see [Figure 13.7](#), left column) and is normally found in mass game kills achieved by driving herds into swamps or over cliffs and in populations that perished of natural causes. The **attritional age profile** (see [Figure 13.7](#), right column) shows an underrepresentation of prime-age animals relative to their abundance in living populations, but young and old are overrepresented. This profile is thought to result from scavenging or simple spear hunting.

Klein found that the Cape buffalo age distributions from both sites were close to those observed for modern buffalo killed by lions, maybe because both young and old males are vulnerable to attack as they are isolated from the large herds of formidable prime animals. Thus, he argued, the Stone Age hunters at both caves enjoyed a lasting, stable relationship with their prey populations of buffalo. The distributions for eland and bastard hartebeest (smaller, gregarious antelopes) were much

more similar to the catastrophic profile. Klein speculates that they were similar because these species were hunted in large game drives, as were the bison on the American Great Plains. Thus, entire populations would be killed at one time. Age distributions can reflect all kinds of other activities as well. The Star Carr site in northeastern England contains no young red deer. Most of the animals were three or four years old, inexperienced subadults killed as they were leaving their mothers (Legge and Rowley-Conwy, 1987).

Hunting and slaughter patterns are subject to all manner of subtle variables, many of which were described by Lewis Binford (1978, 1981). While studying hunting practices among the Nunamiut of Alaska, he found that the hunters butcher animals as part of a much broader subsistence strategy. The Nunamiut rely heavily on stored meat for most of the year and thus orient their hunting practices toward storage objectives, as well as many other considerations. In the fall, they may hunt caribou calves to obtain skins for winter clothing, and the heads and tongues of these animals provide the meat for the people who process the skins. Binford stressed that it is difficult to interpret slaughter patterns without closely understanding the cultural systems of which hunting is a part.

Domestic animals are a controllable meat supply and subject to quite different selection criteria. In more advanced agricultural societies, cattle or horses might have been kept until old age for draft purposes, with surplus males being castrated and females being retained until they stopped lactating or were of no further use for breeding or plowing. Even if riding or work animals were not kept, the problem of surplus males persisted. This surplus was an abundant source of prime meat, and these animals were often slaughtered in their early adulthood. Cattle stood for wealth in many traditional societies, as they do in some today, and they were slaughtered on such special occasions as funerals or weddings. The herd surplus was consumed in this manner, and the owner's obligations were satisfied.

Butchery The fragmentary bones in an occupation level are the end product of the killing, cutting up, and consumption of domestic or wild animals. To understand the butchery process, one must examine the articulation of animal bones in the levels where they are found, or a

close study must be made of fragmentary body parts. The Olsen-Chubbuck kill site in Colorado yielded evidence of a slaughtered bison herd. The hunters camped beside their kill, removing the skin and meat from a carcass and perhaps drying some surplus meat for later consumption. The butchering tools used by the skinners were found in direct association with the bones, so the excavations preserved the moment of butchery for posterity (Wheat, 1972).

Interpreting butchery techniques is a complicated matter, for many variables affect the way in which carcasses are dismembered. The Nunamiut rely heavily on stored meat, and the way they dismember a caribou varies according to storage needs, meat yield of different body parts, and proximity of the base camp. At any base site, the animal's size may affect the number of bones found: goats, chickens, or small deer could have been carried to the village as complete carcasses, but only small portions of larger beasts may have been brought in. Sometimes animals with high meat yield are consumed where they are killed, and every scrap of flesh and entrails is utilized. Even with the NISP and MNI indices, interpretation is difficult.

Once again, the problem is to establish the meaning of archaeological distributions in terms of human behavior. Just how complicated this is in the context of butchery can be appreciated from Binford's comment (1978) that the Nunamiut criteria for selecting meat for consumption are the amount of usable meat, the time required to process it, and the quality of the flesh.

Plant Remains

Animal bones tell only part of the subsistence story. Throughout human history, people have relied heavily on plant foods of all kinds. For the past 12,000 years, they have grown them as well. In many societies game meat formed far fewer meals than vegetable foods, which are often completely invisible in archaeological sites. For example, the !Kung San, present-day inhabitants of the Kalahari Desert in southern Africa, know of at least 85 edible seeds and roots. Most of the time they eat only eight of these. The rest of the vegetable resource base provides a reliable cushion for this foraging population in times when key vegetable foods are scarce. Such people have a buffer against famine

that many farmers with their cleared lands, much higher population densities, and crops that rely on regular rainfall rarely enjoy. The San's lifeway raises a question: Is a farming life really to be preferred? A few studies of the skeletons of early farming populations show how malnutrition due to food shortages was commonplace in many areas.

Seeds, fruits, grasses, and leaves are among the most fragile of organic materials and do not survive long unless they are carbonized or preserved under very wet or arid conditions. In recent years, **paleoethnobotanists**—scientists who recover, identify, and study ancient vegetable remains and assess the relationships between people and plants—have made major strides in the study of plant remains, using a variety of methods and lines of evidence that were unimaginable in earlier years.

Macrobotanical Remains

Macrobotanical remains were long the only major source of information on plant remains. They are easily recognizable items such as pine nuts, maize cobs, charred nuts or seeds preserved in a hearth or charcoal, and very rarely remains of cooked meals. Carbonized and unburned seeds are normally found in cooking pots, in midden deposits, or among the ashes of hearths, where they were dropped by accident. Though the preservation conditions are not ideal, researchers can identify domestic and wild plant species from such discoveries (Pearsall, 2009). However, even where the seeds are preserved, the identification of carbonized seeds is not always straightforward. For example, various carbonized grains identified as early “domesticated” sorghum grains found in Southwest Arabia and India have been called into question (Fuller and Madella, 2000).

The extremely dry conditions of the North American desert West and of the Peruvian coast have preserved thousands of seeds, as well as human coprolites that contain a wealth of vegetal material. Hogup Cave in Utah was occupied as early as 7000 B.C. . From about 6400 to 1200 B.C. , the inhabitants relied so heavily on pickleweed seeds in their diet that the early deposits are literally golden with the chaff threshed from them (Aikens, 1970; Simms, 2008). Deposits of pickleweed and the milling stones used to process it from after 1200 B.C. decline rapidly. An

abrupt rise in the nearby Great Salt Lake may have drowned the marsh where the seed was collected, so the cave was only visited by hunting parties.

Four 19,000- to 17,000-year-old hunter-gatherer camps at the Wadi Kubbania site in the Egyptian desert have yielded remarkable collections of charred plant foods, some apparently roasted seeds preserved in human infant feces. The inhabitants brought back more than 20 types of food plant. The most common were nut grass tubers, which are easily collected by the ton with simple digging sticks and are used as famine food when crops fail in West Africa and India today. Indeed, harvesting the wild tubers each year fosters new growth. When cooked to make it nontoxic, nut grass can serve as a staple, and may in fact, have fulfilled such a purpose at Wadi Kubbania (Hillman, 1989; Wendorf, 1980).

Perhaps the most famous macrobotanical finds come from the Tehuacán Valley in the state of Puebla, Mexico. Sites in the valley have provided a record of continuous human occupation, from the earliest times to the Spanish Conquest, and a unique chronicle of early maize cultivation (MacNeish, 1970). Early inhabitants of the valley lived mainly by hunting rabbits, birds, and turtles. Later, about 6700–5000 B.C., their successors subsisted mostly on wild plants such as beans and amaranth. These people were seasonally mobile hunter-gatherers who eventually added the deliberate cultivation of plants to their seasonal round without making radical changes in their lifeways. The dry valley caves document a gradual shift from wild-plant foraging to an almost total dependence on cultivated crops, including maize and beans; and within a few centuries of full domestication of maize, the people had moved into permanent village settlements anchored to their fields.

The wild ancestor of maize was an indigenous grass, teosinte (*Zea mays* subspecies *parviglumis*), which still grows in Central America. Botanists believe that both maize and beans were domesticated from identifiable wild ancestors in the Guadalajara region, some 155 miles (250 km) west of the Tehuacán Valley, where both teosinte and a population cluster of wild beans still flourish (Smith, 1999). Richard MacNeish excavated more than a dozen sites in Tehuacán, five of which contained the remains of ancient corn; 80,000 wild-plant remains and 25,000 specimens of corn came from the sites. Early maize cobs came

from the lowest occupation level in San Marcos Cave, dried ears no more than three-quarters of an inch (20 mm) long. This was fully domesticated maize, incapable of dispersing its kernels naturally, as wild plants do to regenerate. The mature plants would have stood about 4 feet (1.2 m) high with one to five ear-bearing lateral branches, each plant producing 10–15 small corn ears (see [Figure 13.8](#)). Originally, MacNeish estimated their age at between 7,000 and 5,500 years ago, but AMS radiocarbon dating on actual cobs from San Marcos and Coxcatlán caves indicates only as early as 4,700–4,600 years ago (about 2700 B.C.), 1,000 years or so later than originally thought.

There are numerous other examples of informative microbotanical remains. Maya farmers in northern Belize cultivated raised fields in wetlands. The waterlogged soils contained avocado, maize, and other domesticated grass seeds. At Dust Cave in Alabama, already described in [Chapter 7](#), the inhabitants processed large quantities of hickory nuts and acorns, also black walnuts, hackberry, and hazelnuts. But hickories were the dominant nut, the discarded shells being used as fuel, for they have a high fat content and burn hot. Acorns were an important staple throughout the west and elsewhere. They have the disadvantage that they require quite lengthy processing to leach out toxins, but provide both protein-rich food and have the priceless quality of being easily stored for months, an important consideration for people living in arid environments with only seasonal nut harvests.

[Figure 13.8](#) The evolution of maize through the various stages in the transformation from teosinte to maize. The earliest teosinte form is (a); the stabilized maize phenotype is (e). The harvesting process increased the condensation of teosinte branches and led to the husks becoming the enclosures for corn ears.

Source: Walter Galinat, “Domestication and Diffusion of Maize,” in Richard I. Ford, ed., *Prehistoric Food Production in North America*. Ann Arbor: University of Michigan Museum of Anthropology, 1984.

Flotation Recovery

Flotation techniques have been employed systematically to recover seeds in recent years. The method uses water or chemicals to free the seeds, which are often of microscopic size, from the fine earth or

occupation residue that masks them; the vegetal remains usually float and the residue sinks. Although this technique enables us to recover seeds from many sites where doing so was once impossible, by no means can it be applied universally, for its effectiveness depends on soil conditions. Using flotation, Stuart Struver and his colleagues recovered more than 36,000 fragments of carbonized hickory nutshells from ovens, hearths, and storage-refuse pits in the Apple Creek site in the lower Illinois Valley. This settlement also yielded 4,200 fragments of acorn shell, as well as more than 2,000 other seeds from at least three species. Few cultivated seeds were found, indicating that the inhabitants relied on hickory nuts and acorns for much of their vegetable diet (Smith, 1992).

Flotation has revolutionized the study of prehistoric vegetal remains. The methods used are being refined as more experience is gained with them under varied field conditions. A number of ingenious machines have been developed to carry out large-scale flotation (see [Figure 13.9](#)). The sample of earth is poured into the screened container and agitated by the water pouring into the screen. The light plant remains and other fine materials float on the water and are carried out of the container by a sluiceway that leads to fine mesh screens, where the finds are caught, wrapped in fine cloth, and preserved for the botanists to study. The heavy sludge, in the meantime, sinks to the bottom of the container.

Flotation is rewriting the early history of farming in all parts of the world, partly because it yields much larger samples of domestic and wild seeds to work with. Andrew Moore used flotation with great efficiency on the Stone Age farming village at Abu Hureyra on the Euphrates River in Syria. He acquired 712 seed samples from soil deposits that comprised a bulk of more than 132 gallons (500 liters). Each sample contained as many as 500 seeds from over 150 plant taxa, many of them edible. By studying these large samples, botanist Gordon Hillman was able to document the retreat of oak forests in the region, and the changes in plant gathering that accompanied environmental change. He showed that Abu Hureyra had been in the grip of a prolonged drought in about 10500 B.C. At first, the people turned to drought-resistant, small-seeded grasses. Then they abandoned Abu Hureyra, probably moving to places close to permanent water, where experiments with the cultivation of cereal crops began. As more

favorable conditions returned in about 9700 B.C. , a farming settlement appeared at Abu Hureyra, based on the cultivation of emmer, einkorn, and barley, staple cereal crops that were rotated with legumes such as lentils, vetches, and chickpeas. But the people still supplemented their diet by collecting significant quantities of wild vegetable foods (Moore, 2000). They lived in the same place for a long time because they rotated their crops and used a simple fallow system that allowed exhausted fields to recover before being replanted.

Figure 13.9 Model of a flotation device for recovering plant remains using recycled water, developed by botanist Gordon Hillman. The lightest remains float to the surface and are caught in float sieves. The heavier material sinks and is caught in light nylon mesh.

Grain Impressions

Apart from the seeds themselves, which reveal what the food plants were, grain impressions in the walls of clay vessels or adobe brick help to uncover the history of agriculture or gathering. The microscopic casts of grains that adhered to the wet clay of a pot while it was being made are preserved in the firing and can be identified with a microscope. Numerous grain impressions have been found in European handmade pottery from the end of the Stone Age. Grain impressions have been studied in southwestern Asia, Arabia, and the western Sahara Desert; some related work on adobe bricks has been carried out in the western United States.

Palynology

Pollen analysis has been an extremely valuable tool for analyzing European forest clearance (see [Figure 13.10](#); see also [Chapter 12](#)). About 4000 B.C. , in northern Europe the components of high forest—oak, ash, beech, and elm—simultaneously declined, while the pollen of grasses increased sharply. At many locations, charcoal layers underlie the zone where forest trees declined. The increase in grass pollen was also associated with the appearance of several cultivation weeds, including *Plantago*, which is associated with cereal agriculture in Europe and went with European farmers throughout the world, even to North America. The tree cover vanished as a direct result of farming activity—

humanity's first major imprint on the environment. Similar pollen curves have been plotted from data gathered elsewhere in Europe.

Pollens are minute and can travel long distances, which means that samples from an archaeological site provide but a generalized impression of what people might have found to eat in the vicinity. Such impressions can be invaluable. For example, the Paiute and Shoshone Indians of the Great Basin relied heavily on upland plants such as piñon nuts, whereas the people living near the Stillwater Marsh in the Carson Desert, Nevada, about 1,000 years ago, appear to have relied almost entirely on plant foods from nearby wetlands. They seem not to have walked 12 miles (20 km) to obtain piñons from higher ground.

Figure 13.10 Pollen diagram from northern Ireland that documents the impact of farmers on the prehistoric landscape. About 4150 B.C., tree pollen counts fall dramatically as farmers first clear the forest. At the same time, grasses and field weeds take over. Subsequently, the farmers abandon the fields and the forest regenerates before being cleared again after 3280 B.C.

S i T E > Abu Hureyra, Syria <

Abu Hureyra, one of the earliest farming villages in the world, was excavated by Andrew Moore and a team of researchers in the 1970s. Thanks to state-of-the-art science, especially flotation, we know much about the transition from foraging to farming at Abu Hureyra (Moore, 2000).

The first village of pit houses with reed roofs was built about 11500 B.C. and flourished for 500 years. The climate was damper and warmer than today. Abu Hureyra lay in well-wooded steppe, where animals and wild cereals were abundant. The hamlet lay close to woodland and open country and to the fertile river floodplain, where wild cereal grasses could be harvested. Each spring, Abu Hureyra's hunters preyed on thousands of migrating Persian gazelle, which moved northward with the changing season (see [Figure 13.11](#)). They killed thousands of them and dried the meat for later use (Legge and Rowley-Conwy, 1987).

With such a favorable location, Abu Hureyra increased in size to 300 or 400 people, until a long drought cycle, and perhaps deforestation due to heavy firewood consumption, caused abandonment of the settlement. About 9700 B.C., another village rose on the same site. This was a much

larger village that grew to cover nearly 30 acres (12 ha). At first the inhabitants still hunted gazelle intensively. Then, about 9000 B.C., within the span of a generation or so, they switched to herding domesticated sheep and goats and to growing cereal crops. Visitors to the village would have found themselves wandering through a closely knit community of rectangular, one-story, mudbrick houses, joined by narrow lanes and courtyards.

Figure 13.11 The prehistoric mound of Abu Hureyra.

Source: Courtesy of Andrew Moore.

Andrew Moore's very thorough excavations show us that each gradual or rapid change in the subsistence pattern or environment of Abu Hureyra instituted by humans led to a complicated chain reaction affecting every sector of the inhabitants' culture.

The Chilean wine palm (*Jubaea chilensis*) is the largest in the world, growing to a height of at least 65 feet (20 m). The tree yields a valuable sap to make honey or potent wine, and the nuts have a prized oily kernel. At the time of its first settlement by Polynesian voyagers in about A.D. 1200, Easter Island (Rapa Nui) in the South Pacific supported forests of wine palms. Pollen diagrams from the island show that a combination of Pacific rats, who arrived with the first settlers, and human burning and cutting helped destroy the palm forests, diminished water supplies, and cut the inhabitants off from the outside world by destroying the timber used for offshore canoes (Hunt and Lipo, 2011).

Plant Phytolith Analysis

Opal phytoliths, minute particles of silica from plant cells, are produced from hydrated silica dissolved in groundwater that is absorbed through a plant's roots and carried through its vascular system (Piperno, 2006). Silica production is continuous throughout the growth of a plant. Phytolith samples are collected in much the same way as pollen samples, and then they are studied by identifying individual species. Most research in the field has been with grasses, so the archaeological applications are obvious, especially in the study of prehistoric agriculture.

Anna Roosevelt used phytolith analysis on sites in the Orinoco River

valley of Venezuela. She found that the percentages of grass phytoliths had increased dramatically at the very time when maize was introduced to the area, as indicated by carbon-13 and carbon-12 analysis of skeletal material and actual seeds. Deborah Pearsall and Dolores Piperno have developed a complex formula for distinguishing between phytolith samples produced by modern maize and those produced by wild grasses (Pearsall and Piperno, 1990). They analyzed soil samples from radiocarbon sites in coastal Ecuador and found phytolith evidence for the presence of maize in layers radiocarbon-dated to as early as 8,000–7,000 years ago. When these results were first announced, they seemed in broad agreement with the earlier chronology for maize at Tehuacán. But AMS dating of actual Mexican cobs has shortened the time frame considerably. There are no cobs in the Ecuadorian sites, and the average size of wild and possible domesticated phytoliths was tiny. Thus, Pearsall and Piperno's results are somewhat controversial (Smith, 1999). In recent years, much research has focused on tropical root crops, where analyses of starch grains on stone tools offer a potential avenue of research (Piperno and Holt, 1998).

In archaeology, phytolith analysis has many potential applications in the study of diet, through the use of coprolites and even phytoliths embedded in jawbones, but research is still in its infancy.

Bone Chemistry

Bone and stable isotopes, described earlier in the chapter, provide valuable information on diet at a general level. For instance, the bone chemistry of the inhabitants of Pecos Pueblo in the American Southwest shows that they ate predominantly maize and very little meat. Northwest coast populations tended to have diets that relied heavily on maritime foods, as one would expect.

These are but a few of the methods, which are now used to study ancient plant remains. These inconspicuous, and hitherto often neglected, finds can throw valuable information on important questions. Samples from flotation analysis can provide enough seeds to record differences in seasonal occupation. For instance, a spring visit in search of one form of edible grass that ripens in spring and is

overwhelmingly abundant in the sample is clear evidence for seasonal occupation. But a word of caution: Ancient environments differed often dramatically from those of today, so any study of plant use cannot be divorced from a parallel understanding of the surrounding environment at the time. Plants had, and still have, important symbolic and ritual associations in many societies, among them hallucinogenic mushrooms, peyote. Many ancient societies had encyclopedic knowledge of medicinal and poisonous plants for curing all manner of diseases and for such esoterica as toxic arrowhead poisons, and substances such as aconite, smeared by Native Americans in Alaska on their whaling harpoons and lances.

Birds, Fish, and Mollusks

Birds

We eat chicken and other birds and devour their eggs in quantities that dwarf any such consumption in the past. Many of us use down pillows and sleeping bags. Feathers sometimes serve as decorations. For the most part, however, birds have little impact on modern life, except when epidemics of avian flu and other diseases hit the headlines. Birds assumed much greater importance in the past, for people observed their flight, colors, and songs. Eagles and other birds of prey could bear powerful omens, signal potential victory or defeat. Many, such as the raven, had powerful spiritual associations in many societies, served as clan symbols, or carried messages to and from the supernatural realm. Bird feathers adorned headdresses and clothing, were worn in the hair as powerful identifiers. Late Ice Age Europeans fashioned bird bone flutes at least 30,000 years ago. Flocks of geese and other migrating birds signaled the arrival of spring and fall in many places, as enormous multitudes flew north and south along well-defined flyways, like that through the Mississippi Valley. Aborigines in northern Australia knew well that Torres Island pigeons would arrive from the northwest to feed on wild plums in September. Medieval Irish monks and Norse seafarers are said to have followed the paths of migrating geese to Iceland in the North Atlantic.

Humans have had complex relationships with birds for thousands of

years, since at least the appearance of anatomically modern *Homo sapiens*, but bird remains have been long neglected in archaeology until recent years (Serjeantson, 2009). A few pioneer researchers recognized their importance, especially Hildegard Howard, who studied a large collection of bird bones from an enormous shell midden at Emeryville on San Francisco Bay. She found (1929) that waterbirds were the predominant species, especially ducks, geese, and cormorants, and that land birds distinctive of hill country were absent. All the geese were winter visitors, mostly found in the bay area between January and April of each year. The cormorant bones were nearly all immature, suggesting that the Indians had been robbing cormorant rookeries; most of the cormorant bones equaled an adult bird's in size, but ossification was less complete, equivalent to that in modern birds about five to six weeks old. Howard examined rookery records and estimated that a date of June 28 each year would be the approximate time when the rookeries could be raided. She concluded the Emeryville mound was occupied during both the winter and the early summer, and probably all year.

The basic procedures for identifying bird bones are virtually identical to those used for larger mammals, as are the ways of studying age, sex, and health of the finds, as well as butchery methods. There are, however, complex questions to be answered, notably about the associations of the bones with people. Were bird bones the result of deliberate hunting or natural accumulations? If killed by humans, were birds taken for their flesh, feathers, and skins, or for their strong, delicate bones? Such questions require close collaboration between those studying the bones and the excavators. Take, for example, the case of waterfowl hunted for thousands of years along the Mississippi flyway. Thousands of birds were netted, trapped, or shot with light arrows in spring and fall. Most of the carcasses were then dried for later consumption, a process that can be identified with meticulous excavation of butchered skeletons. Hunting bands visited caves near the Carson Sink in the Great Basin for thousands of years, preying on the waterfowl that abounded there. Well-made reed and grass decoys, some of them worn on the head, tell us that the hunters would float quietly among the oblivious birds, then grab them quickly by the legs below the surface, or use the decoys to attract live waterfowl that could be shot from the nearby reeds or shoreline (Fagan, 2019).

Simple snares made from sticks and fiber accounted for many kills, especially of walking birds. The birds found in some African hunting and farming sites are almost invariably species that rarely fly and are easily snared, such as guinea fowl. No traces of the snares have been found in excavations, for they would have been made of perishable materials. Late Ice Age hunters in Central Europe appear to have made extensive use of snares to catch Arctic ptarmigan. Bird hunting assumed considerable importance to hunting societies in a newly forested Europe after the Ice Age. Thousands of tiny microlithic arrow barbs served as lethal tips for light arrows used against both waterfowl and forest birds. Bird hunting may have been especially important in months when game and plant foods were in short supply.

Figure 13.12 Bone fishhooks of the Maglemose culture in northern Europe. (Two-thirds actual size.)

Fish

Fishing, like fowling, became increasingly important as people began to specialize in different and distinctive economies, and as their environmental adaptations became more sophisticated, and their technological abilities improved. Evidence for this activity comes from both artifacts and fish bones (Figure 13.12) (Fagan, 2017).

Freshwater and ocean fish can be caught in various ways. Nets, basket traps, and dams were widely used since 10,000 years ago, but their remains rarely survive in the archaeological record except in dry sites or waterlogged deposits. Basket fish traps have been found in Danish peat bogs, dating to earlier than 6000 B.C. . The ancient Egyptians employed somewhat similar traps, depicted in Old Kingdom tomb paintings (2575–2134 B.C.). Nets remained the most popular fishing device and were used in northern Europe in Holocene times, too (Figure 13.13). A larger fish weir, constructed of vertical sticks of 4–16 feet (1.2–4.9 m) long and sharpened at one end with a stone ax, enclosed an area of 2 acres (0.8 ha) at Boylston Street, Boston. The weir was built about 2500 B.C. . and was probably the work of coastal Archaic people. Such traps were evidently widely used along the Atlantic Coast, built in estuary areas where tidal currents were strong. In the Boston weir, brush and flexible withies—twigs or branches—were placed between the

stakes; fish were diverted into the enclosure by “leaders,” also made of brush, leading to the trap mouth. Some days’ work must have been necessary to build this weir, which provided an almost inexhaustible food supply for its designers.

Figure 13.13 Ancient Egyptian fisherfolk pulling in a net full of fish. From the Mastaba (tomb) of the priest Mereruka, c. 2340 B.C. .

Source: Courtesy of PRISMA ARCHIVO/Alamy Stock Photo.

Fishhooks, harpoons, and barbed spearheads are frequent finds in lakeside or riverside encampments. The earliest fishhooks had no barbs, but they did have a U-shaped profile ([Figure 13.12](#)). Postglacial hunting peoples, such as the Maglemose folk of Denmark, used such artifacts in the seventh millennium B.C. , in all probability to hunt pike, a prized freshwater fish in prehistoric times.

Artifacts alone tell us little about the role of fish in the prehistoric economy or about the fishing techniques of prehistoric peoples. Did they fish all year or only when salmon were running? Did they concentrate on bottom fish or rely on stranded whales for protein? Originally, researchers contented themselves with merely listing major fish species and little more. Everything changed during the 1960s, when they realized there was far more to studying an ancient community than counting stone artifacts or comparing potsherds. They turned to animal bones and plant remains, and later to fish, for the information they could yield. By the 1970s, excavators were passing samples of occupation deposits through fine-mesh screens and water, especially to recover inconspicuous plant remains and fish bones. Wet sifting, often called flotation, has produced a surge of knowledge about ancient fisheries. The finer the screen the better. At the 9,000-year-old Norje Sunnansund site in southeastern Sweden, using a 5-mm sieve as opposed to a 2.5-mm size reduced fish bone recovery by 94 percent. The identification of these tiny bones, by comparing them against modern fish skeletons, has become a well-refined if esoteric practice. Today, fish specialists can also tease out answers to far subtler questions than size and species. What ages were the fish? Were they caught only in spawning season or year round? What role did they play in the diet? What butchery and preservation methods were used? The list of

questions and answers is limited only by the imagination and ingenuity of the excavators. For instance, the development of stable isotope analysis for bone chemistry has contributed much to our understanding of ancient diets. One can now use samples from human bones to discover how much of the diet came from maritime versus terrestrial foods.

How did ancient peoples preserve fish? Drying and salting game meat was certainly routine in Ice Age societies that were constantly on the move and lived through long, severe winters. Fish presented a somewhat different challenge, for their flesh spoils rapidly, especially that of oily species like herring. Drying was easy in cold northern landscapes, especially in spring when the sun shone and strong winds dried out fish like cod laid out on wooden racks. But drying and smoking large catches in cold but wetter northern environments was often impracticable due to the prevailing damp and short fishing seasons. Thanks to a fortunate discovery, we now know that early Scandinavian fishers turned to fermentation. The Norje Sunnansund site, occupied twice between 7600 and 6600 B.C., lies on the shore of an ancient lake in southeastern Sweden, close to an outlet to the Baltic (Boethius, 2016). People lived here most of the year, especially during the colder months, at a time when winter temperatures were about 1.5°C cooler than today. They consumed large quantities of freshwater fish, many of which archaeologists recovered from a narrow gutter the people had dug into underlying clay. It lay at the lake's edge, excavated on a slight slope that ended up in a pit, and was full of fish bones. Unlike the rest of the site, where perch and pike were common, the pit contained 80 percent roach. Roach are small and bony, hard to eat unless the bones are softened. The Norje Sunnansund people most likely used some fermentation process to make the roach edible. In modern times, a broad swathe of circumpolar people from Greenland to Kamchatka fermented fish without using salt. Many groups buried them in a hole dug into underlying clay close to water, to minimize transporting the catch. This seems to be what the Norje Sunnansund people did. They may also have fermented roach in airtight sealskin or wild boar bags, parts of which were found in the gutter. Stake holes around the gutter hint at a relatively permanent structure to keep out predators. Judging from the enormous numbers of bones, enough fish

were being fermented to support large numbers of people, allow food surpluses to accumulate, and foster more sedentary settlement.

The Lofoten Islands off northern Norway lie close to a vast spawning ground for North Atlantic cod. *Gadus morhua* has white flesh that has a low oil content and is easily dried or salted. The Lofoteners caught thousands of cod from open boats in midwinter and then dried them on racks in the sunny and windy spring. Dried cod were an equivalent to beef jerky for Norse voyagers sailing to Iceland or deep into Europe. Easily stored and light, the fish would keep for many months, and could be chewed and eaten raw or pounded and then cooked. Sophia Perdikaris has studied cod bones from archaeological sites on the island. Sea fishing was a staple of the local economy long before specialized and permanently settled villages caught and dried millions of cod for export. Excavations at the Langenesvaeret site show that the islanders used permanent fishing camps for many centuries before cod became a near-industrial commodity. Cod were a desirable food not only because they were admirable provisions for sailors and soldiers, but also because they were an acceptable food for Catholics during the 40 days of Lent and on holy days, which by A.D. 1200, comprised nearly half the year. The demand was insatiable; Bergen in western Norway became the cod capital of medieval Europe. Perdikaris found that in earlier times the local fishers caught a wide range of species. They dried large numbers of cod, but much of the fishery was for local subsistence. But when the cod demand skyrocketed, they turned from subsistence to specialized fishing. After A.D. 1150–1200, the Vågan settlement, also on Lofoten, contained cod bones to the virtual exclusion of all others. These were often articulated backbones, but almost no heads since the fishers removed the heads before drying the catch, just as their modern successors do today. Furthermore, the size of the Vågan cod peaks in a window identical to that of modern-day dried cod (Perdikaris, 1999).

The Calusa people of southern Florida were shallow water fishers, whose origins lay in much earlier maritime societies as early as 500 B.C. They lived in estuarine environments, where short-term changes in local sea levels radically affected the fishery. Calusa communities used decentralized ways of adapting to their subtropical environment, relying heavily on net fishing and adapting effortlessly to such climatic events as the Medieval Warm Period between A.D. 800 and 1200, when

they relied heavily on a great variety of small fish as well as consuming enormous numbers of whelks, conches, and other marine snails. The Calusa accumulated huge shell middens and constructed steep-sided shell mounds, causeways, ramps and canals. Their society, fed by a simple fishing and foraging technology, developed considerable social complexity. The research, most of it based on Pine Island Sound, is some of the most thorough and exemplary fish and mollusk research anywhere (Marquardt and Walker, 2012).

Since fish are a relatively predictable food resource, lakeside or seaside fishing encampments tend to be occupied longer than hunting camps because the food supply, especially when combined with the collection of shellfish, is both reliable and nourishing.

Mollusks

Shellfish from seashores, lakes, or rivers formed an important part of ancient diet for many thousands of years (Bar-Yosef Mayer, 2005). They were also used for ornamentation in the form of beads or pendants, as prestige ornaments denoting status and for trade. Some larger shells served as adze blades for making canoes and other woodworking tasks. The identification of the mollusks in shell middens is a matter for expert conchologists, who possess a mine of information on the edibility and seasons of shellfish.

In many regions such as California, southern Florida, and the Cape of Good Hope region of South Africa, marine and freshwater shellfish mollusks were a valuable supplemental food at times of scarcity during the year or a source of variety in a staple diet of fish, game, or vegetable foods.

When freshwater or seawater mollusks were collected, the collectors soon accumulated huge piles of shells at strategic places on the coast or on the shores of lakes, near rocky outcrops or tidal pools where mollusks were commonly found. A remarkable study of the Gidjingali Aborigines of northern Australia provides unique insights into this most inconspicuous of foraging activities (Meehan, 1982). The Gidjingali live on a coastline of sand dunes and mangrove swamps. They are constantly on the move, shellfish being the constant in their diet, to the point that they call their constant homeland a

“supermarket.” To collect shellfish required an intimate knowledge of the tides, of movements of sandbanks, and the effects of storms. They collected 29 shellfish taxa, working year-round, but especially during the periods of big tides in spring and fall, catching about 16,100 pounds (7,300 kg) of shellfish a year. If the Gidjingali research is any guide, shellfish of all kinds were a significant part of many ancient hunter-gatherer diets, when available. Above all, they were a reliable food source in periods of scarcity and a way of managing the risk of hunger.

Modern midden analysis involves systematic sampling of the deposits, and counting and weighing the various constituents of the soil. The proportions of different shells are readily calculated, and their size, which sometimes changes through time, is easily measured. California shell middens have long been the subject of intensive research, with the changes in frequency of mollusks projected against ecological changes in the site areas.

The La Jolla culture middens of La Batiquitos Lagoon in San Diego are a notable example of such analysis. Claude N. Warren took column samples from one shell mound and found that the remains of five species of shellfish were the dominant elements in the molluscan diet of the inhabitants (see Crabtree, 1963). The changes in the major species of shellfish were then calculated for each excavated level. They found that *Mytilus*, the bay mussel, was the most common in the lower levels and was gradually replaced by *Chione*, the Venus shell, and *Pecten*, the scallop, both of which assumed greater importance in the later phases of the site’s occupation, which has been radiocarbon-dated from the fifth to the second millennia B.C. Warren found that *Ostrea*, the oyster, a species characteristic of a rocky coast, was also common in the lower levels, indicating that the San Diego shore was rocky beach at that time, with extensive colonies of shellfish. By about 6,300 years ago La Batiquitos Lagoon was silted to the extent that it was ecologically more suitable for *Pecten* than the rock-loving *Mytilus*. Soon afterward, however, the lagoons became so silted that even *Pecten* and *Chione* could no longer support a large population dependent on shellfish. The inhabitants then had to relocate. Similar investigations elsewhere in California have also shown the great potential of mollusks in the study of prehistoric ecology.

Many peoples collected mollusks seasonally, but it is difficult to

identify such practices from the archaeological record. Growth bands in mollusk shells have been used to measure seasonality, but the most promising approach is to measure the oxygen-isotopic ratio of its shell carbonate, which is a function of the water temperature (Lightfoot and Cerrato, 1988). Using a mass spectrometer, you can measure the oxygen-18 composition at the edge of a shell, obtaining the temperature of the water at the time of the mollusk's death. It is hard to determine actual temperatures, but you can gain an idea of seasonal fluctuations, thereby establishing whether a mollusk was taken in winter or summer.

Both freshwater and seawater shells had ornamental roles as well. Favored species were traded over great distances in North America. Millions of *Mercenaria* and *Busycon* shells were turned into wampum belts in New England in early colonial times. *Spondylus gaederopus*, a mussel native to the Black Sea, the Sea of Marmara, and the Aegean, was widely distributed as far north and west as Poland and the Rhineland by European farmers in the fifth millennium B.C. Andean lords in both coastal and highland states prized *Spondylus* as a sacred shell, which was buried with the Lord of Sicán, among others (see the Site box on page 214 in [Chapter 11](#)). The *Conus* shell, common on the East African coast, was widely traded, finding its way into the African interior and becoming a traditional perquisite of chieftainly prestige. The nineteenth-century missionary and explorer David Livingstone recorded that, on his visit to Chief Shinte in western Zambia in 1855, the going price for two *Conus* shells at that time was a slave; for five, a tusk of elephant ivory.

Subsistence Data from Rock Art

Rock art is a major source of information on economic activities. Upper Paleolithic cave art in southwestern France depicts dozens of mammal species, perhaps meant to represent large, meaty animals that were economically (and symbolically) valuable (Bahn, 2016).

Much more detailed information comes from southern Africa. Over half a century ago, African archaeologist J. Desmond Clark (1959) published an account of Late Stone Age hunting and gathering practices in southern Africa in which he drew heavily on the rock art of Zimbabwe and South Africa. The paintings depict the chase, weapons,

collecting, and camp life.

Other rock art from both the Horn of Africa and South West Arabia shows scenes of domesticated cattle and other animals (Soukopova, 2012). These have been used to help date the appearance of domesticated species in this area (Negash, 1997). Furthermore, by identifying similar artistic styles in different geographic regions (including a common “Ethiopian-Arabian” style of pastoral rock art in Saudi Arabia), people have suggested the various routes through which the various ethnic groups then disseminated these domesticated species. However, using rock art to such ends is controversial. First, there are very real difficulties involved in dating rock art (meaning that poorly dated rock art has then been used to date other processes, such as animal domestication). Second, the identification of different styles—and by extension different ethnic groups—in art has also been called into question (Khan, 1994). Nonetheless, used in tandem with other data, rock art is a useful line of enquiry and certainly can provide insights on early agricultural practices (Phillipson, 1993).

Not only rock art but also pottery can throw light on prehistoric subsistence. The Mimbres culture developed in southwestern New Mexico in the late first millennium A.D. and is famous for its black-on-white painted pottery that was produced mainly between A.D. 950 and 1150 in some 20 villages along the Mimbres River (Nelson and Hegmon, 2011). The potters depicted humans, other mammals, birds, reptiles, fish, insects, and mythical creatures. About 11 percent of the images are fish, many of them species that can be identified as being native to the Gulf of California, more than 450 miles (724 km) away. Both the distribution of modern fish species and the marine mollusks found in Mimbres villages strongly suggest that the people had visited the ocean, perhaps to collect marine shells for making beads (Jett and Moyle, 1986). (See [Figure 13.14](#))

[Figure 13.14](#) The base of a Mimbres bowl depicting a bighorn sheep.

Source: Courtesy of John Cancalosi/Alamy Stock Photo.

Ancient Diet

The ultimate objective of the archaeology of subsistence is not only to

establish how people obtained their food, but also to reconstruct their actual diet. Dietary reconstruction is difficult, mainly because of incomplete economic information. Yet the problems involved are fundamental. What proportion of the diet was meat? How diverse were dietary sources? Did the principal sources of diet change from season to season? To what extent did the people rely on food from neighboring areas?

Sources of Data on Diet and Nutrition

There are only a few sources of data on prehistoric diet and nutrition, and these are subject to serious limitations. Human skeletal remains can sometimes provide evidence of ancient malnutrition and other conditions attributable to diet (Larsen, 1999). For example, the parish church of Rothwell in Britain's Midlands has a massive bone crypt that houses the remains of more than 20,000 people disinterred from the graveyard when the church was expanded in the thirteenth century A.D., as well as skeletons from a nearby sixteenth-century hospice. A preliminary study of some of the bones has shown that many of these medieval people and later people suffered from malnutrition, as well as from arthritis, tuberculosis, and other infections. Fractures were also common (Shackley, 1985).

Biological anthropologist Jane Buikstra has studied diet and health among the prehistoric populations of the lower Illinois Valley. As early as 5500 B.C., the inhabitants of this area began harvesting hickory and other nuts on an ever-larger scale. Nuts provided a high-quality food resource, but to support large numbers of people, they had to be harvested over large areas. As time went on, the growing population of the valley turned more and more to wild seeds, especially oily ones such as marsh elder, that were high in protein and a concentrated source of food energy. In time, they actually cultivated marsh elder as well as sunflowers, whose seeds had equivalent food value. They supplemented the oily species with starchy seeds such as knotweed that were highly dependable and easily stored. In the last half of the first millennium A.D., the starchy seeds gave way to cultivated maize. Buikstra observes that, as much more complex social organization and regional trade evolved, so dental diseases became much more common

and tuberculosis spread among the dense village populations. The introduction of maize appears to have coincided with a deterioration in child health, too (Buikstra, 1984).

Was food stored? What limitations or restrictions did technology or society place on diet? All these questions lie behind any inquiry into prehistoric subsistence.

Diet (what is eaten) and **nutrition** (the ability of a diet to maintain the body in its environment) must be studied in close conjunction, for they are quite distinct from subsistence, the actual process of obtaining resources. The baseline for any study of prehistoric diet and nutrition must be surveys of modern hunter-gatherers, subsistence cultivators, and pastoralists. Unfortunately, however, lack of agreement among dietary experts is so widespread that it is difficult to estimate the caloric needs of prehistoric peoples. So many cultural, medical, and physiological factors must be weighed, even in modern situations, that research of prehistoric nutrition and food consumption will often be little more than inspired guesswork. Despite such recovery methods as flotation, it is still impossible to assess the intake of vitamins, minerals, and milk products in prehistoric diets. Nor do we have adequate data on the wastage of food during preparation and storage or on the effects of different cooking techniques. Archaeological data can indicate only some of the foods eaten by prehistoric communities and show, at least qualitatively, how important some of them were generally. We are far from being able to ascribe precise food value to animal and plant remains, as would be demanded for precise studies of diet and nutrition.

Stable carbon isotope analysis involves identifying types of plant foods from the isotopic analysis of prehistoric bone and hair. By using the ratio between two stable carbon isotopes—carbon-12 and carbon-13—in animal tissue, researchers can establish the diet of the organism (Bogaard and Outram, 2013). Research on controlled animal populations has shown that as carbon is passed along the food chain, the carbon composition of animals continues to reflect the relative isotopic composition of their diet. Carbon is metabolized in plants through three major pathways: C_3 , C_4 , and Crassulacean acid metabolism. The plants that make up the diet of animals have distinct carbon-13 values. Maize, for example, is a C_4 plant. In contrast, most indigenous temperate flora

in North America is composed of C_3 varieties. Thus, a population that shifts its diet from wild vegetable foods to maize will also experience a shift in dietary isotopic values. Because carbon-13 and carbon-12 values do not change after death, you can study archaeological carbon from food remains, soil humus, and skeletal remains to gain insight into ancient diet. This approach is of great importance to archaeologists studying dietary patterns, especially when combined with information from other sources.

For example, excellent organic preservation at the Windover burial grounds in eastern Florida allowed a team of researchers to combine an archaeobotanical analysis with bone-collagen stable carbon isotope and nitrogen-isotopic studies of human skeletal remains. They were interested in the degree of reliance on marine as opposed to terrestrial food resources among the people buried at Windover between about 6000 and 5000 B.C. A comparison of nitrogen-isotopic values from human bone collagen at Windover with values from coastal sites shows that the inhabitants of the former made little use of marine resources. Many C_3 plants were part of the Windover diet, with duck and catfish, with intermediate C_3/C_4 values also significant. The plant remains from the site, such as elderberry, included virtually all C_3 plants, confirming the isotopic data and data from well-preserved stomach contents. The research team believes it has evidence for seasonal foraging based on wild plant foods, freshwater, and estuarine resources over a long period of time (Tuross et al., 1994).

Staple isotope analysis on crops, animal bones and human remains can yield insights into agricultural strategies and diet thousands of years ago. A team of researchers has investigated two major sites in northern Greece with fascinating results (Nitsch et al., 2017). The final stage of the Early Bronze Age village at Archontiko of around 2080 B.C. included a row of seven rectangular dwellings, with shared walls that burned down, preserving stored crops and cooking facilities. The site was then abandoned for three centuries before houses with stone-built foundations came into use, with the same kind of closely spaced dwellings with shared walls. In contrast, Middle and Late Bronze Age mound sites like Thessaloniki Toumba, dating to after 2000 B.C., had blocks of houses separated by narrow streets. This was much more formal architecture combined with storage rooms that foreshadowed

the larger, more hierarchically organized Iron Age settlements of later times. The two Early and Late Bronze Age settlements display subtle social differences that had implications for the handling of food and food surpluses.

Isotopic analysis linked farming and herding strategies to human diet at Archontiko and Thessaloniki Toumba. At both sites, crops were the main protein source. Interestingly the amount of manuring varied considerably, with a particular emphasis on barley, which may have served both as early pasture for the village herds as well as human food. The variations between crops probably reflect versatile strategies for juggling limited manure supplies, also crop schedules, and available labor. Agriculture was relatively intense, with manuring increasing dramatically in Late Bronze Age Thessaloniki Toumba, perhaps a reflection of increased use of draft animals and closer integration of goats and sheep with arable land. At both sites, cattle bones yielded evidence for use of C₄-rich habitats, probably the coastal salt marshes with flourish near Archontiko. This type of grazing would have had one major advantage: fattening cattle without consuming valuable fodder. Staple isotope analysis of plants, animals, and a few human burials has linked actual farming practices and diet, as well as hinting at the ways in which these Bronze Age communities planned for—and exploited—food surpluses that served both nutritional and social needs.

The stable carbon isotope method is not restricted to use with agriculture; it has been applied with success to measure the reliance on marine species of medieval Norse colonists in Greenland, who settled there during the tenth century A.D. at a time of favorable ice conditions in the North Atlantic during the Medieval Warm period (see [Chapter 12](#)). The Norse were cereal and cattle farmers and took their stock with them from their homeland in Iceland. At the height of their occupation until A.D. 1300, the Norse relied heavily on their herds for sustenance. Carbon isotopes from their teeth enamel show that fish and other marine foods were less than 20 percent of their diet in the generations after first settlement. But the percentage rose to 80 percent as the climate grew colder after 1300. Declining temperatures at the onset of the Little Ice Age meant that the growing season for hay, the critical winter fodder, shortened significantly. Many cattle died during the winter, so the Norse turned to fish and sea mammals for more of their

diet (McGovern and Perdikaris, 2000). By 1450, conditions were so cold in Greenland that the Norse abandoned their settlements.

Isotopic and elemental analyses of prehistoric skeletons have been useful in the study of the origin and spread of maize in the New World, by using stable carbon isotopes of skeletal collagen and as a way of detecting the consumption of marine foods. For instance, isotope analyses show that about 70 percent of the diet of the Maya inhabitants of Copán, Honduras, came from maize. There remain important potential avenues of inquiry. Can one, for example, establish the importance of meat in early hominin diets?

Concentrations of strontium, a stable mineral component of bone as opposed to calcium, can be used to measure the contribution of plants to diet. For instance, it has been shown that prehistoric people in the eastern Mediterranean ate much the same proportions of meat and plant foods from 100,000 years ago up to the end of the Ice Age. Then there was a significant shift toward the consumption of plant foods.

Stomach contents and feces provide unrivaled momentary insights into meals eaten by individual members of a prehistoric society. Dietary reconstructions based on these sources, however, suffer from the disadvantage that they are rare and represent but one person's food intake. Furthermore, some foods are more rapidly digested than others. But even these insights are better than no data at all. The stomach of Tollund Man, who was executed around the time of Christ, contained the remains of a finely ground meal made from barley, linseed, and several wild grasses; no meat was found in the stomach contents (Glob, 2004). (See [Figure 4.4](#) on page 68.)

Many American scholars have studied human **coprolites** (feces) from dry caves in the United States and Mexico. Such researches include analyses of microscopic food remains found in the feces and also of pollen, phytoliths, and parasites (Reinhard and Bryant, 1992). Since the 1980s, researchers in southwestern Texas have obtained coprolite evidence for a basically stable hunter-gatherer diet over 9,000 years of hunting and gathering in this arid region. Dry conditions in coastal Peru have also provided valuable information on changing diet along the Pacific Coast. Coprolite analysis has become highly sophisticated, especially since the advent of DNA analysis, which is often well preserved in feces and can establish whether a sample comes from a

human. Much of the effort now goes into establishing what parasites had infected their owners.

Some coprolite studies in North America have analyzed pollen grains found in human feces. Fifty-four samples from Glen Canyon in Utah showed that the pollen ingested by their owners could yield valuable information on plants eaten, seasonal occupation, and even the medicinal use of juniper stem tea. Vaughn Bryant (1974) analyzed coprolite pollen from a site near the mouth of the Pecos River in southwestern Texas. He found that the inhabitants of the site between 800 B.C. and A.D. 500 spent the spring and summer at this locality. During their stay, they ate many vegetable foods, including several types of flowers. One danger of using pollen grains is that of contamination from the background pollen “rain” that is always with us. But Bryant was able to show that all but two of the species represented in the pollen were local plants. In all these instances, valuable insights were obtained into minor details of prehistoric diet, as well as into intestinal parasites that were commonplace among peoples living on a diet of game meat that was often slightly rotten (“high”) (Horne, 1985). Finally, human coprolites can sometimes help to shed light on even greater questions. For example, those found in 14,000 year-old deposits in Paisley Cave, Oregon, are some of the earliest traces of human settlement in the Americas (Jenkins et al., 2012).

Summary

1. Archaeologists rely on many sources to reconstruct prehistoric subsistence methods. These include environmental data, animal bones, carbon isotopes, vegetal remains, human feces, artifacts, and prehistoric art.
2. Zooarchaeology involves the study of animal bones. Bone identification is carried out by direct comparison between modern and ancient bones.
3. Game animal remains can give insights into prehistoric hunting practices. The proportions of animals present can be affected by cultural taboos, the relative meat yields of different species, and hunting preferences. Overhunting and extinction can also affect

the numbers of animals in a site.

4. Early domesticated animals are very difficult to distinguish from their wild ancestors. Domestication alters both the characteristics of an animal and its bone structure.
5. Slaughtering and butchery practices can be derived from the frequency and distribution of animal bones in the ground. Teeth can be used to establish the age of animals slaughtered, but hunting and slaughter patterns are subject to all manner of subtle variables, including convenience and season of the year. Understanding the cultural systems of which the food remains are a part is essential for interpreting slaughter and butchery patterns.
6. Carbonized and unburned plant remains are recovered from hearths and pits, often using a flotation method to separate seeds from the matrix around them. Dry sites, such as the rock shelters and camps in the Tehuacán Valley of Mexico, provide abundant evidence for early crop domestication. Grain impressions on European pots are studied to reconstruct prehistoric agriculture in the Old World. Danish archaeologists have used pollen analysis to study forest clearance in temperate zones during early farming times.
7. Bird bones give valuable information on seasonal occupation; fish remains reflect specialized coastal adaptations that became common in later prehistoric times.
8. Hooks, nets, and other artifacts, as well as fish remains themselves, provide insights into both coastal and offshore fishing practices.
9. Freshwater and saltwater mollusks were both consumed as food and traded over enormous distances as prestigious luxuries or ornaments.
10. Ancient diet and nutrition must be studied together, for they are distinct from subsistence, which is the actual process of obtaining food. It is difficult to estimate the caloric needs of modern peoples, let alone those of ancient groups. Archaeological data can indicate only some of the foods eaten by prehistoric communities and show their importance in general. But this is far from ascribing their true caloric importance to

ancient societies.

11. Human skeletal remains, stomach contents, and feces are the few direct sources available for information on ancient diet. Staple isotope research is revolutionizing the study of ancient diet.

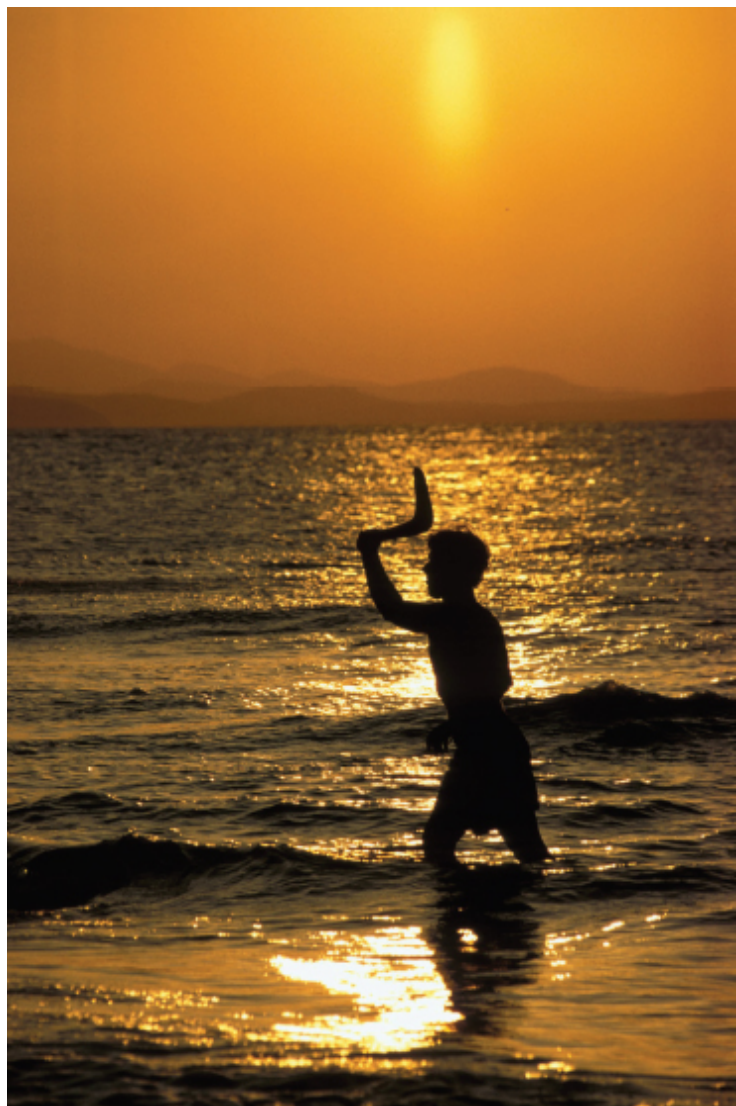
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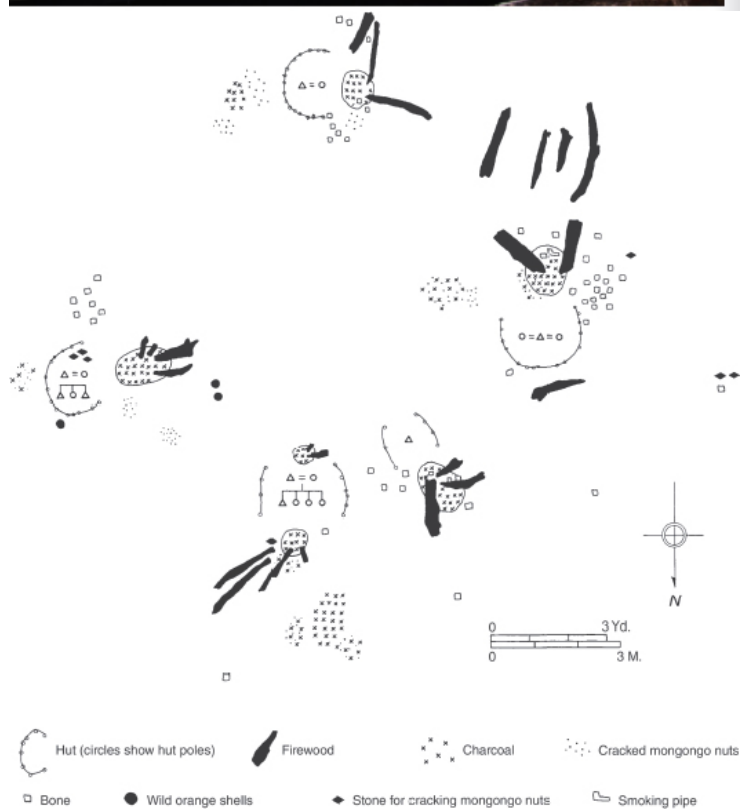


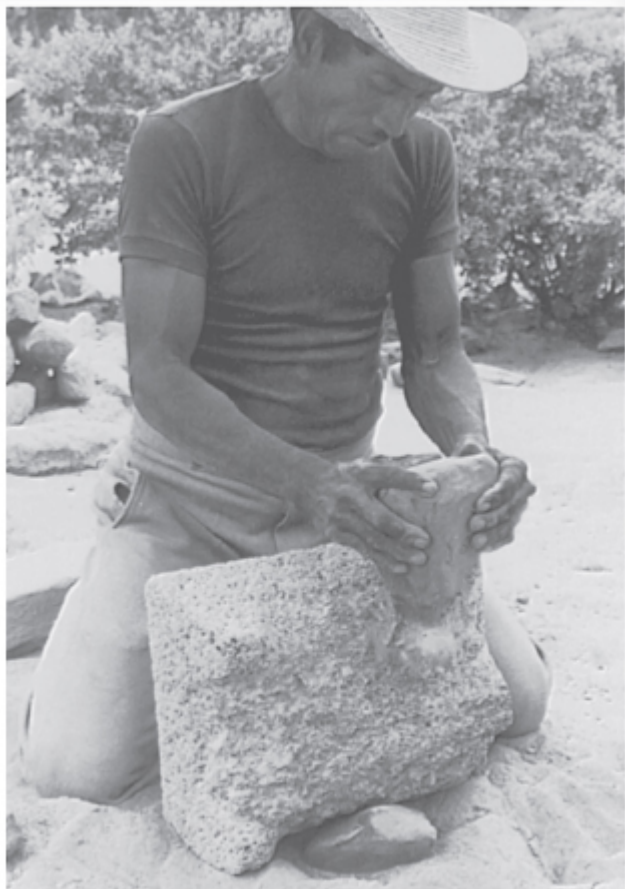






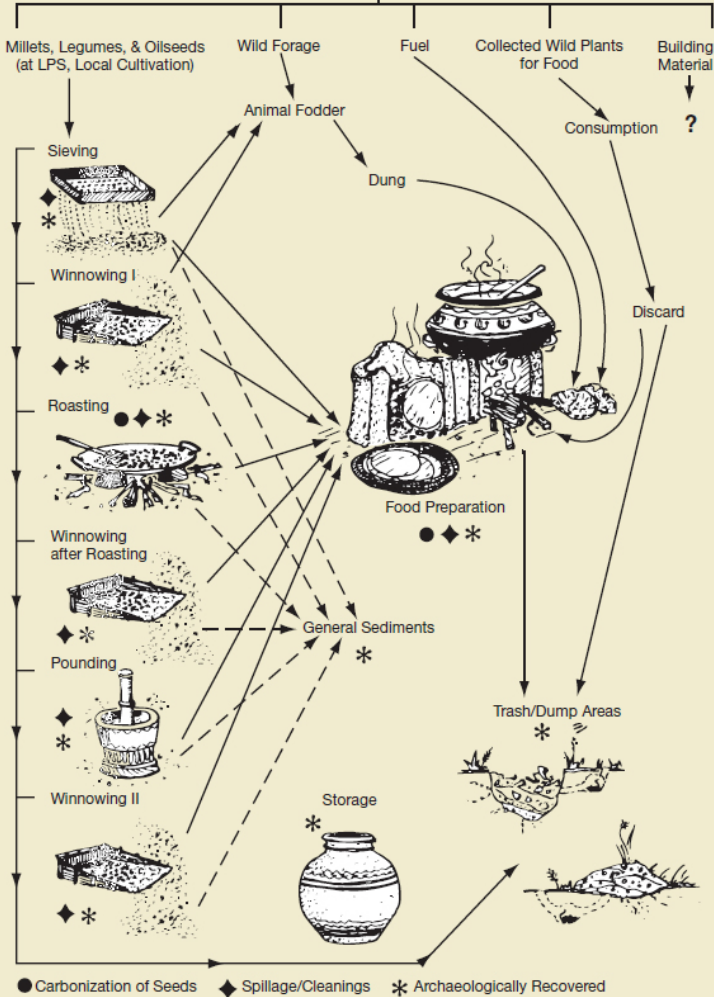








Usage and Disposal on the Site







14

The Living Past

CHAPTER OUTLINE

[Early Comparisons](#)

[Analogy](#)

[Middle-Range Theory](#)

[Ethnoarchaeology](#)

[Experimental Archaeology](#)

Even today, you can sometimes get a glimpse of ancient life, long before Western industrial civilization. Sailing up the Nile River, you see Egyptian villages looking virtually unchanged from 2,000 years ago. In the heart of Central Africa, the rhythm of farming life, with its endless cycles of planting and harvest, of life and death, is virtually unchanged

from centuries ago. Our modern world gives archaeologists many opportunities to look from the present into the past far more convincingly than one might think. So far, we have considered the processes of archaeological research—data acquisition, analysis, and interpretation. This chapter looks more closely at the tools that archaeologists use to bridge the gap between the world of the past and the archaeological record of the present: analogy, middle-range theory, ethnoarchaeology, and experimental archaeology.

A !Kung San hunter draws his bow in the Kalahari Desert.

Source: Courtesy of imageBROKER/Alamy Stock Photo.

Early Comparisons

Archaeologists have long recognized the value of comparisons between prehistoric and modern cultures (Van Reybrouck, 2013). [Chapter 2](#) discussed the evolutionists of the late nineteenth century, who considered living tribes to be good examples of successive stages of development in culture history. Each stage of cultural development was correlated with a stage of technology, a form of the family, a kind of religious belief, and a type of political control that could be observed in some group of people. Thus, the Australian Aborigines, the Eskimo, and the San—who retained a hunter-gatherer way of life, manufactured stone tools, and had no knowledge of metallurgy—were considered to be living representatives of Paleolithic peoples. Many early investigators thought that the most primitive Stone Age peoples were matriarchal, had no government, and believed in numerous spirits. They thought that it was perfectly in order to turn to the literature on Eskimo or other living hunter-gatherers for the “correct” interpretation of artifacts in the archaeological record.

Analogy

Analogy is a process of reasoning that assumes if objects have some similar attributes, then they will share other similarities as well. It involves using a known, identifiable phenomenon to identify unknown ones of broadly similar type. It implies that a particular relationship

exists between two or more phenomena because the same relationship may be observed in a similar situation. As Ian Hodder has pointed out (1999), analogy is central to archaeological research, which is much concerned with relationships between different finds and pieces of evidence. Our abilities to reason by analogy are often tested in aptitude examinations by such questions as: “A fish is to water as a bird is to: (a) a tree, (b) a house, (c) air, (d) grass seed.” Obviously, if we grasp the relationship between fish and water, we will have no trouble completing the question.

[Figure 14.1](#) Australian Aborigine throwing a boomerang on Great Keppel Island, Queensland. Archaeologists often make use of an ethnographic name, such as a boomerang, assuming that their artifact is identical to boomerangs used by the people who made the artifact. This is a simple example of an archaeological analogy.

Source: Courtesy of Mark A. Johnson/Alamy Stock Photo.

Analogy in archaeology involves inferring that the relationships among various traces of human activity in the archaeological record are the same as, or similar to, phenomena found among modern culturally “primitive” peoples. Analogies in archaeology only suggest what modern human behavior is capable of and what the boundaries of prehistoric behavior might have been. Researchers can use them to generate hypotheses that can then be tested by real archaeological data.

Archaeologists use analogy on many levels. In a simple one, a researcher infers that small, pointed pieces of stone are projectile points because there are ethnographic records of peoples who make small, pointed pieces of stone for the tips of lances or arrows. People often make use of an ethnographic name, such as arrowhead, as a label for an artifact. In doing so, they are assuming that their artifact type, which they recognize by attributes whose presence cannot be explained by natural processes, is identical in form to other, known arrowheads used by the people who made the kind of artifact in question (see [Figure 14.1](#)) But this simple analogy is a far cry from claiming similarities—or analogies—between the ways in which the prehistoric culture referred to used the arrowhead and the ways in which a living society uses it. To do the latter is to assume that the relationship between the form and

the function of the artifact has remained static through the ages. If you explain the past simply by analogy with the present, you are assuming that nothing new has been learned by many generations of people and that the past was not much—if any—different from the present.

Many archaeologists make use of analogies based on the technology, style, and function of cultures as they are defined archaeologically. J. G. D. Clark (1952) wrote an economic prehistory of Europe in which he made systematic and judicious use of analogy to interpret such artifacts as freshwater fish spears that were still common in historical European folk culture. This type of analogy is secure enough, as are those about small, pointed pieces of stone claimed to be arrowheads (Wylie, 1985). Enough of these have been found embedded in the bones of animals and people for us to safely acknowledge that such tools were most likely projectile points. Still, we have no way of knowing if the points were part of ritual activity as well as the hunt. Similarly, archaeologists will have information about how houses were constructed and what they looked like, what plants were grown and how these were prepared for food, and perhaps some facts on grave furniture. But they will not know what the people who lived at this site thought a proper house should look like, which relatives would be invited to help build a house, what spirits were responsible for making crops grow, who in the house customarily prepared the food, or whether the people believed in life after death, or even how such practices might have changed over the life of the site. Most analogies drawn from the ideas and beliefs of present-day people are probably inadequate.

Archaeologists develop analogies in many ways. One approach is direct historical analogy, using the simple principle of working from the known to the unknown. In archaeological problems, the known is the living people with written records of their way of life, and the unknown is their ancestors for whom we have no written records. Text-aided analogies involve using written records to interpret archaeological data. Ivor Noël Hume, working at the colonial settlement on Martin's Hundred, Virginia, found some short strands of gold and silver wire in the cellar of one of the houses. Each was as thick as a sewing thread, the kind of wire used in the early seventeenth century for decorating clothing. Noël Hume turned to historical records for analogies. He found European paintings showing military captains

wearing clothes adorned with gold and silver wire and a resolution of the Virginia governor and his council in 1621 forbidding “any but ye Council & heads of hundreds to wear gold in their clothes” (Noël Hume, 1982). Using this and other historical analogies, he was able to identify the owner of the house as William Harwood, a member of the council and the head of Martin’s Hundred.

According to the proponents of the direct historical approach, confidence in interpretation of past lifeways diminishes as we move from historic to prehistoric times. Analogies to living peoples become less and less secure as we become remote from written records. Nevertheless, many archaeologists have taken a functionalist approach to analogy.

DISCOVERY Pre-Clovis Settlement in Texas, 2011

The search for the first Americans has baffled archaeologists for well over a century. One of the defining events came in 1926, when Jesse Figgins of the Colorado Museum of Natural History unearthed a stone projectile point in direct association with the bones of an extinct bison near Folsom, New Mexico. Six years later, even earlier Clovis points with their distinctive fluted bases came to light with more bison bones near the New Mexico town of that name. However, it was not until after World War II that stratigraphic excavations proved that Clovis was earlier than Folsom. Today, we know that the makers of Clovis points flourished over an enormous area of North America and into Mexico, nomadic hunter-gatherers who pursued game large and small and also subsisted off a wide array of plant foods. Dozens of radiocarbon dates show that Clovis people expanded over a wide area of the Americas between about 13,050 and 12,800 years ago. But were the Clovis people the first Americans? For years, most people assumed that they were. “Clovis first” became conventional archaeological dogma—but it is wrong.

There is absolutely no question that small numbers of human settlers arrived in the heart of North America before Clovis points came into use. However, the archaeological “signature” that they left behind them is, to put it mildly, both elusive and sketchy. A scattering of far-from-diagnostic stone tools at various locations, thin occupation layers in rock shelters, even a scattering of human coprolites from Paisley Cave

in Oregon—both the signature and the associated dates are difficult to pin down. Thanks to a recent Texas discovery, we can now be certain that people were living in North America as early as 15,500 years ago.

The Debra L. Friedkin site near Buttermilk Creek in central Texas lies close to a year-round water supply and a high-quality chert outcrop, a rock ideal for stone tool making (Figure 14.2). The excavators dug meticulously through stratified layers, starting with Folsom, then Clovis, each with distinctive artifacts, then into three lower levels, which also yielded stone tools. There was no charcoal in the layers, for it does not preserve well in this region. So Michael Waters and his colleagues turned to optically stimulated luminescence (OSL), which measured the light energy trapped in quartz and feldspar grains in the clay. The lowest level with tools dated to around 15,500 years ago, a good 2,000 years before the earliest Clovis sites (Waters, 2011).

The stone tools found at the Friedkin site include blades and bifaces (artifacts flaked on both sides), which are very like those found with later Clovis tool assemblages, suggesting some continuity between the two cultural traditions. The bifaces were made in the same way as those made by Clovis people. Furthermore, the artifacts from the lowest levels bear the distinctive signs of edge wear resulting from working bone, wood, and hide processing. Unlike some other pre-Clovis sites, there is absolutely no doubt that the earliest Friedkin artifacts were humanly manufactured and that the tools were lying where they were originally dropped. The stratigraphic sequence is impeccable; the OSL dates produced using state-of-the-art technique, the artifact analysis as rigorous as modern science could make it.

The Friedkin discoveries provide important proof that there were human beings in the Americas long before Clovis. They also hint that there was some degree of cultural continuity between Clovis and Pre-Clovis. But, like many important discoveries, this important find raises as many questions as it answers. How did Pre-Clovis people live? What kinds of camps and dwellings did they use? How widespread was such settlement? And, of course, we still have to answer the question of questions. When did human beings first settle in the Americas? Thanks to the Friedkin excavation, we now know that it was at least 15,500 years ago.

Figure 14.2 Excavations at the Debra L. Friedkin site, Texas.

Source: Courtesy of Centre for the Study of the First Americans, Texas A&M University.

Functionalist ethnographies integrate various aspects of culture with one another and with the adaptation of the culture as a whole to its environment. Functionalism stresses the notion that cultures are not made up of random selections of traits, but that culture traits are integrated in various ways and influence one another in fairly predictable ways. Much of processual archaeology, with its emphasis on adaptation and cultural systems, falls under the general title of functionalist archaeology. Functionalist thinking is evident in the way in which many archaeologists select analogies from the ethnographic data to help them interpret their archaeological finds. Because several ethnologically known cultures might provide reasonable analogies, functionally oriented scholars suggest selecting the ones that most resemble the archaeological culture in subsistence, technology, and environment—and that are least removed from the archaeological culture in time and space.

We might want to know about the role of sandal making among the Great Basin Indians of 6,000 years ago. Were sandals produced by men, women, individuals on their own initiative, or formal groups working together? If we consider sandal making as an aspect of technology, we might turn to the ethnographic literature on Australian and San material culture, in which sandals are sometimes featured. Among both the San and the Australian Aborigines, domestic tasks are generally done by women working alone or with one or two helpers. The analogy might lead us to argue that sandal making was regarded as a domestic task by Great Basin people and was carried out by women who usually worked alone. Conversely, weaving is men's work among the Pueblo Indians and is done in special ceremonial rooms; because much ritual performed there today reflects very ancient Pueblo Indian practices, we might be led to infer by analogy that the Great Basin people of 6,000 years ago did not regard weaving as domestic work, so it was carried out by men. No matter which alternative we chose, we probably would not have much confidence in our choice.

The selection of possibly appropriate analogies from the

ethnographic literature is increasingly being seen as only the first step toward interpretation. Once several analogies have been chosen, the implications of each are explicitly stated and then tested against the archaeological data. In our example of sandal making among Great Basin peoples, the ethnographic literature provided conflicting analogies. If we want to gain confidence in selecting one analogy over the other, we must state explicitly the implications each would have for the archaeological data and then examine the latter again in the light of each implication. If sandal making were a domestic task done by women working alone, we might expect to find the raw materials for sandal manufacture associated with tools that more surely represent women's work, such as grinding stones for food preparation. We might also expect to find tools for sandal making (such as awls and scrapers for preparing fiber) among the debris of more domestic sites. We could anticipate that women working alone might introduce more variation into the finished product than might be the case for products made by group effort or by individuals working in the company of other specialists. A contrasting list of implications for the possibility that men produced sandals could also be made, and both sets could be tested against the archaeological data.

Devising test implications is not an easy task. To find a measure for the amount of variation in a finished product that one would expect under specific production conditions requires sophisticated measurements, various statistical tests, and often experimentation among groups of people. Archaeologists willing to make the effort entailed in this approach, however, have found that they are able to discover more about ancient societies than was previously thought possible. Reasoning by analogy is, of course, an important part of this process, but it is only one step in the archaeologist's task. Analogies provide the material from which test implications are drawn; they are not ends in themselves. Thus, analogy is not necessarily misleading, provided that the right criteria and research strategies are used to strengthen and evaluate inferences made from ethnographic and other analogies.

A great deal of archaeological analogy assumes that, because an artifact is used in a specific way today, it was used in that way millennia earlier. The great contribution of the processual archaeologists

has been not in their search for general laws but in their insistence that independent data should be used to test and verify conclusions from surveys, excavations, and laboratory analyses. The basic objective in using hypotheses and deductions—the scientific method, if you will—is not to formulate laws but to explore the relationship between past and present. This relationship is assumed to have two parts. The first is that the past is dead and knowable only through the present. The second is that accurate knowledge of the past is essential to understanding the present.

Whatever one's approach to archaeology, the leading problem in archaeological analogy is to let the present serve the past. Many archaeologists try to achieve this end with three interlocking approaches that help them study the past by using the present:

1. ***Middle-Range Theory***: methods, theories, and ideas from the present that can be applied to any time period and anywhere in the world to explain what we have discovered, excavated, or analyzed from the past.
2. ***Ethnoarchaeology***: the study of living societies to aid in understanding and interpreting the archaeological record.
3. ***Experimental Archaeology***: controlled, modern experiments with ancient technologies and material culture that can serve as a basis for interpreting the past.

Middle-Range Theory

The sociological term **middle-range theory** is used by some processual archaeologists to characterize the body of theory that is emerging as archaeologists develop methods of inference that bridge the gap between what actually happened in the past and the archaeological record of today, which is our chronicle of ancient times (Binford, 1977). Middle-range theory is based on the notion that the archaeological record is a static and contemporary phenomenon—what survives today of the once-dynamic past. How can researchers make inferences about the past unless they know linkages between dynamic causes and static consequences? The dynamic elements of the past are long gone. Binford (1981: 211) and others have searched for “Rosetta stones ... that permit

the accurate conversion from observation on statics to statement about dynamics.”

People of The Past The Subjects of Chinese Emperor

Shihuangdi, 210 B.C .

Emperor Shihuangdi (259–210 B.C.) was the first ruler to unify northern and southern China into a single kingdom, a task that he completed in 221 B.C. Shihuangdi was a cruel and ruthless leader who mercilessly slaughtered his opponents and planned his burial place on a grandiloquent scale. His tomb, a vast burial mound near the city of X'ian that took 37 years to build, still awaits excavation; a task that would defy the expertise of even the most accomplished excavators. The Chinese authorities have wisely chosen to leave it alone for now. We can only guess at the contents, but judging from historical accounts, they are spectacular. Historian Sima Qian, writing about a century after the Emperor's death in 210 B.C. , described some of the treasures in the interior, including a burial chamber with an earthen map of China on the floor with the rivers outlined in mercury, and a map of the heavens on the ceiling with pearls marking the stars. Perhaps Qian's account is correct, for there are high levels of mercury in the soil around the burial mound. Remote sensing undertaken in 2007 revealed that the tomb lies beneath a building 90 feet (27 m) high, with four stepped walls, each with nine steps, perhaps built to allow the emperor's soul to depart this earth.

While the burial mound remains undisturbed, Chinese excavators have made remarkable finds in the precincts around the tumulus. In 1974, local farmers drilling a well stumbled upon a vast pit a mile (1.6 km) east of the burial mound containing full-size terracotta figures of an entire regiment drawn up in battle order. Two years later, two adjacent pits revealed 1,400 members of a cavalry unit and their horses and a 68-member command unit. Only a portion of the regiment has been excavated; an estimated 8,000 men are thought to stand within it. At first, the excavators thought that each soldier had been modeled individually, but we now know that there were ten basic designs. The figures are lifelike, varying in height, uniforms, and hairstyle according to rank. Originally, they were lacquered and painted, each having

different individual features. Each figure carried weapons, but the weapons were stolen by General Xiang Yu, who raided the tomb soon after the regiment was created, and burnt down the wooden structures that once covered the pit. On the west side of the burial mound, a large rectangular chamber of wooden planks housed a pair of bronze carriages, one with four horses, complete with shade and driver. A burial pit located 650 feet (198 m) southeast of the mound measures about 140,000 square feet (13,000 sq. m), almost as large as the terracotta army pit. A test excavation covering about 2,150 square feet (200 sq. m) yielded hundreds of armor and helmet fragments, each made up from thin limestone flakes of various shapes. Armorers strung the fragments together using fine copper wire, which was twisted through fine holes in each flake. The suits were actual-size replicas of actual armor. One suit comprised 612 flakes, weighed 40 pounds (18 kg), and was 4 feet (1.2 m) tall. One of the helmets weighed 7 pounds (3.1 kg), pieced together from 74 flakes. The excavators believe the pit contains a replica of an armory, a military storeroom of the day. Another pit came to light 130 feet (40 m) south of the armory in 1999. A test excavation produced 11 terracotta figures of acrobats of various builds, dressed in short kilts. Some were tall and thin, others were short and strong, each modeled with startling realism. One figure extends a finger, perhaps to spin a plate. The acrobats were intended to entertain the Emperor in the afterlife. Two years later, another burial pit yielded 46 life-size bronze birds—cranes, geese, and swans—all carefully painted and crafted in lifelike poses, as if feeding, all set out on a low platform overlooking a water course through the imperial garden. One of the birds even carried a small bronze worm in its mouth. Fifteen life-sized terracotta figures wearing socks but no shoes knelt and sat elsewhere in the pit. The kneeling figures have raised their arms, as if about to beat something with a stick. The seated figures have extended their arms forward, as if grasping something in their hands. Unfortunately, the instruments they were playing have long since vanished, but the excavators believe they were musicians who would entertain the emperor as he admired the birds in the garden. The excavations and surveys are slowly providing us with a fascinating portrait of court life during the reign of China's first emperor.

Figure 14.3a The soldiers have individual features.

Source: Courtesy of iStock/Thinkstock.

Figure 14.3b The terracotta regiment of Emperor Shihuangdi.

Source: Courtesy of iStock/Thinkstock.

Figure 14.3c Bronze carriage from the precincts of Shihuangdi's tomb.

Source: Courtesy of Melvyn Longhurst China/Alamy Stock Photo.

Middle-range theory begins with three fundamental assumptions:

1. The archaeological record is a static contemporary phenomenon—static information preserved in structured arrangements of matter.
2. Once energy ceased to power the cultural system preserved in the archaeological record, a static condition was achieved. Thus, the contents of the archaeological record are a complex mechanical system, created both by long-dead human interaction and by subsequent mechanical forces and formation processes (Schiffer, 1987; see also [Chapter 4](#)).
3. To understand and explain the past, we must comprehend the relationship between static, material properties common to both past and present and the long-extinct dynamic properties of the past.

According to Binford, middle-range theory helps explain the transformation from past cultural dynamic to present physical residues. It helps reconstruct a long-defunct cultural system by aiding in reconstructions based on appropriate interpretation of the archaeological record. In contrast, general theory seeks to provide a basis for interpreting and explaining a succession of cultural systems, showing how they changed over time, again based on archaeological evidence read across the consecutive cultures. General theory builds on information obtained through middle-range theory.

Middle-range theory is often described as actualistic because it studies the coincidence of the static and the dynamic in cultural systems in the only time frame in which it can be achieved—the

present. It provides the conceptual tools for explaining artifact patterns and other material phenomena from the archaeological record. Michael Schiffer (1987) argues, in contrast, that the subject matter of archaeology is the relationship between human behavior and material culture in all times and places. Binford (1981) considers the archaeological record to be static and material, containing no direct information on the subject whatsoever. Middle-range theory is one way of mediating between the past and the present (Shanks and McGuire, 1996), and as Harold Tschauner (1996) has argued, both processual and postprocessual archaeologists make use of independent sets of information for reconstructing the past. (For a critique of the subject, see Hodder, 1999, and Trigger, 1995.)

Ethnoarchaeology

Middle-range research is important to archaeology, whether one believes that this research is meant to specify the relationships between behavior and material remains or to understand the determinants of patterning and structural properties of the archaeological record.

How can the present, with its rich data on modern subsistence, climate, soil qualities, and myriad other phenomena, be used to interpret the past? A related question is: Do we need to study the present to understand the past? Under our world, with its varied landscape, lies the archaeological record—thousands of sites and artifacts buried since they were abandoned by their makers thousands of years ago. Theoretically, at any rate, we have a wealth of data that could be used to interpret the past, to bridge the gap between sites and peoples as they were in ancient times and the surviving archaeological record of today.

This form of living archaeology, **ethnoarchaeology**, came into its own in the 1970s (David and Kramer, 2001; see also the bibliography in David et al., 1999). Richard Lee was among the anthropologists who studied the !Kung San of the Kalahari, one of the world's last hunter-gatherer groups. He realized archaeologists' difficulties and arranged to take an archaeologist, John Yellen, to study the remains of long-abandoned campsites and compare them with modern settlements (Yellen, 1977). At about the same time, Lewis Binford was working

among the Nunamiut Eskimo and the Navajo, comparing living cultures and archaeological materials and trying to develop workable models of culture as rigorous yardsticks for studying variability (Binford, 1978). More recent research has focused on hunter-gatherer groups such as the Hadza of northern Tanzania, on farming societies such as the Kalinga of the Philippines (Longacre, 1991), and on several southwestern Asian groups.

Ethnoarchaeology is the study of living societies to aid in understanding and interpreting the archaeological record. By living in, say, an Eskimo hunting camp and observing the activities of its occupants, the archaeologist hopes to record archaeologically observable patterns, knowing what activities brought them into existence. Sometimes historical documents can be used to amplify observations in the field. Archaeologists have actually lived on San campsites, then have gone back later and recorded the scattering of artifacts on them or excavated them (Yellen, 1977). The earliest ethnoarchaeological work focused on specific artifact patternings and on studies of hunter-gatherer encampments that might provide ways of interpreting the very earliest human sites at Olduvai Gorge and elsewhere. But a major focus of later work has been to develop archaeological methods of inference that bridge the gap between past and present (Cameron and Tomka, 1993).

Many archaeologists regard ethnoarchaeology simply as a mass of observed data on human behavior from which they can draw suitable hypotheses to compare with the finds from their excavations and laboratory analyses (Gould, 1980). This interpretation is totally wrong; for, in fact, ethnoarchaeological research deals with dynamic processes in the modern world (Layton, 1994).

Ethnoarchaeology Among the San and the Hadza

Much ethnoarchaeological research has been among hunter-gatherers, especially those perceived as having ancestry among earlier, prehistoric peoples (Gamble and Boismier, 1991). Both the San of southern Africa's Kalahari Desert and the Australian Aborigines fall into this category.

As mentioned, anthropologist Richard Lee (1979) has spent many years studying the human ecology of the !Kung San of the Kalahari and

has accumulated a mass of information of use to archaeologists. Archaeologist John Yellen (1977) worked with Lee, collecting data on house and camp arrangements, hearth locations, census information, and bone refuse. Yellen pointed out that a San camp develops through conscious acts, such as the construction of windbreaks and hearths, as well as through such incidental deeds as the discarding of refuse and manufacturing debris (see [Figure 14.4](#)). He recognized communal areas in the campsites, often in the middle of the settlement, that belonged to no one in particular, and family areas focused on hearths that belonged to individual families. The communal activities of the camp members, such as dancing and the first distribution of meat, took place in the open spaces that belonged to no one family. Such activities leave few traces in the archaeological record. Cooking and food processing as well as manufacturing of artifacts normally take place around family hearths. Yellen points out some interesting variations on this pattern: Manufacturing activities taking place at one hearth will sometimes involve people from other families; large skins will normally be pegged out for treatment away from main living areas because of vermin and carnivores. The San study showed that it is dangerous to assume that activities with the greatest archaeological visibility, such as preparing meat or cracking nuts, take place in special places. The activity patterning at San campsites is related, for the most part, directly to family groups. Hypothetically, Yellen argues, it should be possible to use artifact clusters through time to study the development and evolution of such social structures.

[Figure 14.4](#) A San camp in Botswana, Southern Africa, as plotted by John Yellen to show the layout of activity areas and artifacts.

Source: Reprinted from John Yellen, *Archaeological Approaches to the Present: Models for Predicting the Past*. Copyright © 1977, reprinted with permission from Elsevier.

Since 1984, archaeologist James O'Connell and his research team have recorded more than 70 incidents of large mammal butchery by Hadza hunter-gatherers in East Africa (see [Figure 14.5](#)). The Hadza hunt animals when they encounter them, but also ambush them from specially built blinds near water holes in the late dry season. They are

very determined hunters, tracking their wounded prey for hours, even days. They also scavenge meat from predator kills at every opportunity. O'Connell recorded kill rates for a single camp of 70–80 large animals a year, or about one for 40–60 man-days of foraging, with scavenging accounting for about 15–20 percent of the total. The researchers were mainly interested in time allocation, food choice, and food-sharing activities, so they routinely recorded site location, distance from residential bases, method of acquiring the prey, carcass condition, details of the butchery, and the sexes and ages of the people involved. In addition, they collected comprehensive “archaeological” data from each location where possible, including the positions of broken bones and abandoned artifacts.

The Hadza research yielded a mass of basic ethnoarchaeological data that casts serious doubt on many of the assumptions made by archaeologists about hunter-gatherer kill sites. O'Connell's team found that 75–80 percent of the Hadza's large mammal prey were underrepresented in their bone samples, by virtue of the people's hunting and butchering practices. Furthermore, most prehistoric kill sites have been excavated on a small scale, whereas many Hadza butchery sites occupy a large area, through which the hunters scatter the bones, often to find shade in which to work. Sometimes, bones from different animals are also left in separate locations. The disarticulation of animal bones follows a similar pattern, whether carnivores or humans are involved—the limbs first, then the backbone, with differences being more the result of individual animal anatomy than deliberate cultural choice. The Hadza findings cast doubt on many interpretations of animal butchery and highlight the vital importance of ethnoarchaeology and middle-range theory (O'Connell et al., 1992).

Figure 14.5 A team of archaeologists and anthropologists records details of a successful hunt by Hadza hunter-gatherers in northern Tanzania. Data from surveys like this are of great value for interpreting the archaeological record of prehistoric hunter-gatherers.

Source: Photo by B. Hayden.

Lithic Technology Among the Highland Maya

Although ethnoarchaeological investigations have tended to focus on

hunter-gatherers, there are numerous instances of fascinating research on more complex societies, even our own. A major long-term study of modern urban garbage in Tucson, Arizona, for example, is based on the latest archaeological methods and research designs (Rathje and Murphy, 1992). The project is investigating the relationships between resource management, urban demography, and social and economic stratification in a modern context, where some control data from interviews and other perspectives are available to amplify an archaeological study of a type that might be conducted at an ancient urban center. The Tucson garbage study, which is more strictly ethnography than ethnoarchaeology, has produced remarkable results, showing widely different patterns of resource management from one segment of the city's population to another, with the middle class being the most wasteful.

Long-term observations in modern-day peasant societies are providing unexpected dividends, as was the case when Canadian archaeologist Brian Hayden was studying stone tool making among the ancestors of the modern-day Coxoh Maya Indians near the Mexico-Guatemala border. He discovered that some present-day Maya-speaking communities in the area still made and used stone artifacts. Even after four and a half centuries of European contact, a few people were making metates (grinders) in the traditional way, and simple stone tools still fulfilled many basic functions (Searcy, 2011) (see the Doing Archaeology box).

***Doing Archaeology* Maya Stone Metate Manufacture**

Brian Hayden (1987) took advantage of a unique opportunity to record and understand the conception, life, death, and discard of lithic artifacts (or their substitutes). He combined descriptive research with highly exploratory, new theoretical approaches based on design analysis theory, among other things. The research was broad-based, concerned with the properties of the stone collected for tool manufacture, the efficiency of stone technology, and the evolution of the forms of stone tools as they were used and reused. The researchers looked closely at patterns of waste deposition and site-formation processes, and at the social and economic positions of stoneworking artisans. They were able to work closely with a 50-year-old specialist metate maker named

Ramon Ramos Rosario, one of the few full-time specialists still working (see [Figure 14.6](#)).

Because his lands cannot support his family, Ramon makes his living manufacturing manos (pounders) and metates and selling them over a wide area of western Guatemala. He can sell more widely today because of improved public transport. In earlier years, he and other specialists would sell locally. Hayden followed Ramon through the entire manufacturing process, from the selection of the material to the final surface smoothing of the artifact. Time and motion studies showed that it took this expert two-and-a-half days to rough out and smooth a metate blank using only stone tools, and four-and-a-half to five-and-a-half days to finish both a metate and a mano.

Finally, Hayden examined the characteristics of the picks used to chip and peck the rock as if they were archaeological finds, combining these studies with use-wear analysis. Hayden seriated the picks on the basis of the intensity of edge-wear development as a way of estimating the relative length of use of comparable tools. He compared his results with prehistoric artifacts and was able to show that many blunt-edged Maya celts in archaeological sites, tools that were of no use for woodworking, were probably used by women to repeck (roughen) used manos and metates.

The study also threw interesting light on site-formation processes. For example, the stoneworker removes as much waste material from the metate blank at the quarry as possible to save weight. At the same time, he carefully conserves the stone tools used in roughing out blanks, caching them at the quarry and resharpening them to prolong their life. Observations like these, combined with specific environmental conditions, could one day provide a body of what Hayden calls “robust” middle-range theory.

[Figure 14.6 Ramon Ramos Rosario manufactures a stone metate.](#)

Source: [AccentAlaska.com/Alamy](https://www.accentalaska.com/Alamy).

The Maya lithic study demonstrates the power and potential of a many-sided approach to ethnoarchaeology, using data from the dynamic present to evaluate archaeological evidence from the static archaeological record.

Other Studies

Ethnoarchaeological studies of many kinds abound, some of them conducted over many years. In the Philippines, William Longacre has studied Kalinga pot makers, examining not only the actual process of pot making using materials science but also the transmission of ideas, the organization of production, and trade (Longacre and Skibo, 1994). Nicholas David has spent many field seasons working among the Madara of northern Cameroon and Nigeria in West Africa. David and his colleagues have studied changes in material culture among these upland people, who traded with people around Lake Chad to the north over many centuries. The years of study focused on potting and ironworking and on the symbolic meaning of changing artifact styles. The researchers identified what they call a “symbolic reservoir” of fundamental beliefs and integrative social processes that led to broad similarities in material culture over a wide area (David et al., 1991).

Nunamiut Eskimo

Lewis Binford and his students undertook ethnoarchaeological studies to help begin construction of middle-range theory. He decided to study the Nunamiut Eskimo of Alaska, 80 percent of whose subsistence comes from hunting caribou. His aims were to find out as much as he could about “all aspects of the procurement, processing, and consumption strategies of the Nunamiut Eskimo and relate these behaviors directly to their faunal consequences” (Binford, 1978: 61). He chose to concentrate on animal bones rather than on artifacts because, although the bones were not manufactured by humans, the patterns of their use were the result of cultural activity.

The Nunamiut depend more heavily on meat than do any other known hunter-gatherers. Indeed, Binford estimated that each adult eats only around a cup and a half of vegetable foods a year, supplemented by the partially digested stomach contents of caribou. In an environment that has a growing season of only 22 days, the Eskimo rely on stored food entirely for eight and a half months a year and partly for an additional month and a half. Fresh meat is freely available for only two months a year. Binford soon realized that the strategies the Eskimo use to feed themselves are based not only on game distributions but

also on other considerations. With such a heavy reliance on stored food, the problem of bulk is always important. Is it easier to move people to where fresh meat is available or to carry the meat back to a base camp where precious stored food is kept? It is no coincidence that the Nunamiut move around mostly in late summer and early fall, when stored foods are at their lowest levels. The Nunamiut way of life involves complicated and interacting decisions related to the distribution of food resources at different seasons, the storage potential of different animals and of different parts of an animal, and the logistics of procuring, carrying, and storing meat.

By close study not only of the Nunamiut annual round of activities but also of their butchery and storage strategies, Binford was able to develop indices that measured, in exhaustive detail, the utility of different body parts of caribou and to describe the butchering techniques, distribution of body parts, and methods of food preparation used. He showed that the people have an intimate knowledge of caribou anatomy with regard to meat yield, storage potential, and consumption needs—relative to the logistical, storage, and social needs of the moment. The field study also included analysis of 42 archaeologically known locations that dated to earlier times.

The Nunamiut adaptation depended on long-term storage strategies that were keyed to two aggressive periods of caribou hunting: in spring and fall. That the Nunamiut were able to hunt the caribou twice a year was linked to the topography in their homeland, which lies close to the borders of both summer and winter caribou feeding ranges ([Figure 14.5](#)). The movement of the people was keyed to seasonal game movements and to storage and other needs. Fall hunting was directed toward calves, whose skins were used to make winter clothing. Small, mobile parties of Nunamiut would pursue them, knowing that their prey would yield not only skins but also the added bonus of heads and tongues to feed the people who processed the skins. Without taking account of this fact, the Nunamiut would have been unable to maintain a viable cultural system.

What is the importance of the Nunamiut research? First, it provides a mass of empirical data on human exploitation of animals that is applicable not only to the Nunamiut and other caribou hunters but also to the interpretation of different types of archaeological sites in many

parts of the world. Binford showed how local any cultural adaptation is—that the Nunamiut depended on interacting topographic, climatic, logistical, and other realities. The result is considerable variation in archaeological sites and in artifact frequencies and forms.

Such ethnoarchaeological studies show that archaeologists can no longer assume that all variability in the archaeological record is directly related to cultural similarity and difference (David and Kramer, 2001). They have profoundly affected archaeological studies of prehistoric hunter-gatherers, both of the earliest hominins and in more recently occupied areas, such as the Great Basin. So far, the main influence of middle-range theory and ethnoarchaeology has been on the archaeology of hunter-gatherers. One exception to that rule is Harriet Blitzer's long-term study of eighteenth- and nineteenth-century Greek jars (*pithoi*). Blitzer's study has important implications for the study of ancient Aegean trade, which has deep roots in antiquity (Blitzer, 1990; for other exceptions, see David and Kramer, 2001, and Kramer, 1997).

Structures and Symbols

Ian Hodder (1982) took a somewhat different structural and symbolic tack in ethnoarchaeological studies of farming and hunter-gatherer societies in tropical Africa. He studied the Nuba farmers of the Sudan and the Lozi of western Zambia, among other peoples. "Symbols are actively involved in social strategies," he wrote. Every society, he believes, has a set of general conceptual principles that form a "structure" that runs through each society. Structuralism has long been debated in anthropology but is new to archaeology. Under this approach, Hodder would have archaeologists looking for the principles and concepts that played a part in all social and ecological actions in individual ancient societies, a structure that affected the patterning of the material culture found in the archaeological record.

There is little actual difference between the structure of the Binford and Hodder approaches (David and Kramer, 2001). Middle-range theories relate the empirical to the real, as do Hodder's structuring principles, themselves middle-range theories. Where the two schools of thought differ is in their styles of analysis. More science-based approaches rely more heavily on statistics and numerical data, focusing

on behavior rather than on its meaning, and on cross-cultural laws more than on cultural patterns. For most archaeologists, ethnoarchaeology is a way of raising analogical consciousness, of sensitizing them to the dimensions of variability and the richness of the relationship between human beings and their artifacts. But combined with experimental archaeology, and integrating history and science, it can be a valuable way of approaching the realities of the past, which are often hard to discern from the archaeological record.

In recent years, ethnoarchaeologists have become increasingly interested in ideology, notably in West Africa (David et al., 1991), (see the Doing Archaeology box) and in subsistence (see [Figure 14.6](#)).

Ethnoarchaeology is gradually broadening its scope and sharpening its analytical tools as it moves into new and important areas, such as landscape analysis and ideologies. It is an increasingly important tool for archaeological research, with numerous applications in today's world with its inexorable shifts toward cultural homogeneity.

Experimental Archaeology

Controlled experiments with the dynamics of material culture can be a fruitful source of data to test middle-range theory (Ferguson, 2010). **Experimental archaeology** began in Europe during the eighteenth century, when people tried to blow the spectacular bronze horns recovered from peat bogs in Scandinavia and Britain. One ardent experimenter, Robert Ball of Dublin, Ireland, blew an Irish horn so hard that he was able to produce “a deep bass note, resembling the bellowing of a bull.” Sadly, a subsequent experiment with a trumpet caused him to burst a blood vessel, and he died several days later (Coles, 1979). Ball is the only recorded casualty of experimental archaeology. It was not until the early years of the twentieth century that experimental archaeology took on more immediate relevance. One reason that it did was the capture and observation of Ishi, one of the last California Indians to follow a traditional way of life (see [Figure 14.7](#)).

Stone Technology

Only the sketchiest historical accounts of stoneworking and other craft

activities survive in the records of early explorers. Some of the Spanish friars, notably Juan de Torquemada, saw Indian stoneworkers flaking obsidian knives. In 1615, he described how the Indians would take a stick and press it against a stone core with their “breast.” “With the force of the stick there flies off a knife,” he wrote. But until recently, no one knew just how pressure flaking, as it is called, was done (Coles, 1979).

Figure 14.7 Migrating caribou on the Seward Peninsula, Alaska. The Nunamiut and other groups subsist largely off the spring and fall migrations of these gregarious animals.

Source: Courtesy of Accent [Alaska.com/Alamy](https://www.alamy.com/Alaska.com/Alamy) Stock Photo.

Doing Archaeology Ghana’s Sacred Sites, West Africa

Anthropologists have long been interested in the rich culture of the Tallensi people of northern Ghana. The late great Cambridge anthropologist Meyer Fortes (1906–1983) wrote copiously about them. However, Fortes was rather more interested in their kinship and religious practices rather than their material culture. Thus, in 2004 a new project—led by archaeologists from the Universities of Manchester (United Kingdom), Legon (Ghana), and the Upper East Regional Museum (Ghana)—began exploring Tallensi material culture (both present and archaeological). Their ethnographic work—including interviews and field observations—is providing new insights on the local archaeology and may also help to unlock some of the secrets of Stonehenge.

The team has been particularly interested in ritual sites (Insoll et al., 2009). As part of their work, they excavated at the Tallensi shrine of Nyoo. This is one of the most important shrines and the focal point of agricultural ceremonies currently used by the Tallensi. Nyoo was chosen for excavation since much of it has been left as if “in nature,” and is also protected by local community and Earth Priests, meaning the shrine is well preserved. At Nyoo, the archaeologists mapped three primary areas—one of which contained standing and recumbent stones (subsequently dated to the mid-eleventh century A.D.). Since standing stones are no longer erected by the Tallensi, whatever ritual gave rise to

the stones is no longer in existence. Yet, when interviewed, the Tallensi seemed to understand the generic importance of the archaeology, and were also able to offer interpretations for the significance of certain “ritual” deposits found around the stones—linking them with ancestral veneration, and perhaps, in some instances, suggesting that they were buried following the instructions of diviners. This work shows that ethnographic research can certainly offer some interesting insights, but also highlights how we should not assume that present practices can be extrapolated onto the past—not least because culture is dynamic “even” within “pre-industrial” societies.

However, their studies have not stopped there: Ethnographic research at another shrine, known as Tonna’ab, offers some fascinating information, which could be relevant to understanding such far-flung sites (both in terms of time and space) as Stonehenge. Tonna’ab is formed of a rock shelter and set within a piece of woodland. From interviews, the team discovered that the Tallensi regard it as a shrine that hates evil and is thus good at identifying witches, as well as being benevolent and curative, especially with regard to infertility. Because of its perceived powers, Tonna’ab attracts many pilgrims—including neighboring peoples, such as the Mossi and Bulsa but also from further afield, notably southern Ghana where it has a special reputation among the Akan (Ashanti) people.

To meet demands for its powers—curative and otherwise—the archaeologists discovered that Tonna’ab has been “franchised.” To achieve the process of franchising, ideas and material culture need to be moved from Tonna’ab to the area where the new shrine is to be established. Rock can play a role in this franchising process; thus, a small stone from Tonna’ab may be given to the individual seeking to establish a new shrine. Might this practice help to explain the presence of nonlocal stone in other archaeological sites, including Neolithic ritual sites in the United Kingdom? Might notions of franchising help to explain why we find “exotic” rock at sites, such as Stonehenge or West Kennet Long Barrow? Project leader, Tim Insoll, while aware of the constraints of ethnographic research, finds the notion compelling.

The ethnoarchaeological work carried out in Ghana helps not only with interpretations of the local archaeology but also adds potential pieces to archaeology’s more ancient, and indeed nonlocal, jigsaw.

Figure 14.8 Seetha Reddy's analysis of processing cereals at the Indus site of Babor Kot, Gujarat, India. This is an excellent example of the application of ethnoarchaeology to the interpretation of ancient subsistence.

Source: Reproduced by permission of Seetha Reddy and Academic Press (*Journal of Anthropological Archaeology* 16[2]: 162–87 [1997]).

It was an Idaho rancher named Don Crabtree who worked out some of the ways in which the Paleo-Indians had made the beautiful Folsom projectile points found on the Plains. He experimented for more than forty years and was able to describe no fewer than eleven methods of reproducing the “flute” at the base of the artifact (Crabtree, 1972). Eventually, he came across Torquemada's account of pressure flaking and used a chest punch to remove flakes from the base of unfinished points gripped in a vise on the ground. The result was points that were almost indistinguishable from the prehistoric artifacts. Many other researchers have followed in Crabtree's footsteps and have successfully replicated almost every kind of stone artifact made by pre-Columbian Indians. Does the production of an exact replica mean, in fact, that modern experimentation has recovered the original technique? The answer, of course, is that we can never be certain.

Lithic expert Jeff Flenniken has replicated dozens of Paleo-Indian projectile points and argues that many of the different “types” identified by Plains archaeologists are in fact simply heads that were modified for reuse after they were broken in their original use. By reducing an existing head, he argues, the Paleo-Indian artisan produced a different but convenient shape that did the job just as well as the original. The same reduction process might lead the worker to the same shape again and again, but he certainly did not design it that way (Flenniken, 1984). David Hurst Thomas (1986), a Great Basin specialist, disagrees. He argues that modern stoneworkers must not interpret prehistoric artifacts in terms of their own experience, for to do so is to ignore the vast chronological gap that separates us from prehistoric times. Thomas believes that a strictly technological approach to stone tool experimentation restricts the questions to be asked about lithic technology. Lithic experimentation is a valuable approach to the past, but only if combined with other approaches, such as retrofitting or edge-wear analysis.

Figure 14.9 Ishi hunts with a bow and arrow. Studies of Ishi's archery (Pope, 1923) and technological practices (Kroeber, 1965) had important implications for archaeology.

Source: Courtesy of Phoebe Apperson Hearst Museum of Anthropology and the Regents of the University of California.

Criteria for Experimental Archaeology

Experimental archaeology can rarely provide conclusive answers (Ingersoll et al., 1977). It can merely provide some insights into the methods and techniques perhaps used in prehistory because many of the behaviors involved in, say, prehistoric agriculture, have left no tangible traces in the archaeological record. But some general rules must be applied to all experimental archaeology. First, the materials used in the experiment must be those available locally to the prehistoric society one is studying. Second, the methods must conform with the society's technological abilities. Obviously, modern technology must not be allowed to interfere with the experiment. Experiments with a prehistoric plow must be conducted with a plowshare made correctly, with careful reference to the direction of wood grain, the shape and method of manufacture of working edges, and all other specifications. If the plow is drawn by a tractor, the experiment's efficiency will be radically affected; thus, for accuracy, you will need a pair of trained oxen. The results of the experiment must be replicable, and the experiment must consist of tests that lead to suggested conclusions.

Some Examples of Experimental Archaeology

One of the best-known instances of experimental archaeology is the *Kon Tiki* expedition, on which Thor Heyerdahl attempted to prove that Polynesia had been settled by adventurous Peruvians who sailed rafts across thousands of miles of ocean (Heyerdahl, 1950). He did succeed in reaching Polynesia, and his expedition showed that long ocean voyages in rafts were possible, but he did not prove that the Peruvians settled Polynesia.

Most experimental archaeology is far more limited in scope, often involving experiments with spears or bows against animal targets (Odell, 1996). Many experiments have been done on clearance of forests

in Europe and elsewhere. Stone axes have been surprisingly effective at clearing woodland; one Danish experiment yielded estimates that a man could clear half an acre of forest in a week. Tree ringing and fire have been shown to be effective tree-felling techniques in West Africa and Mesoamerica. Experiments with agriculture over eight or more years have been conducted in the southern Maya lowlands and in Mesa Verde National Park. The latter experiment lasted seventeen years. Two and a half acres (1 ha) of heavy red clay soil were cultivated and planted with maize, beans, and other small crops. Good crop yields were obtained in all but 2 of the 17 years, when drought killed the young crop. The test revealed how important careful crop rotation is to preserving the land's carrying capacity.

Housing Experiments Houses of poles and thatch, logs, or hut clay normally survive in the form of postholes, foundation trenches, or collapsed rubble. Unfortunately, traces of the roof and information on wall and roof heights are usually lacking. But this absence has not deterred experimenters from building replicas of Mississippian houses in Tennessee, using excavated floor plans associated with charred poles, thatching grass, and wall-clay fragments (Nash, 1968). Two types of houses dating to A.D. 1000–1600 were rebuilt. One of these was a “small pole” type with slender poles bent over to form an inverted, basketlike rectangular structure with clay plaster on the exterior. Later houses were given long walls, which supported steep, peaked roofs. In this, as in many other instances, many details of the rafter and roof design are probably lost forever.

Butser Hill, England An ambitious long-term experimental archaeology project flourishes at Butser Hill in southern England, where Peter Reynolds reconstructed a communal Iron Age round house dating to about 300 B.C. (see [Figure 14.10](#)). The house is built of hazel rods and a binding mixture of clay, earth, animal hair, and hay. This was part of a much larger experimental project that has been exploring every aspect of Iron Age life. Reynolds and other members of the Butser team grew prehistoric cereals using Iron Age technology, have kept a selection of livestock that resembles prehistoric breeds, and have even stored grain in subterranean storage pits. The project was concerned

not only with how individual aspects of Iron Age subsistence operated but also with how they fitted together. Some fascinating results have come from the Butser experiment. For instance, Reynolds found that wheat yields were far higher than had been expected and that grain could be stored underground for long periods without rotting. The Butser experiment provides valuable information that can be used for calculating prehistoric crop yields and land carrying capacities (Reynolds, 1979).

In the 2000s, a new project was launched at Butser—to delve into the workings of Romano-British life. The focus was on constructing a Roman-style villa with walls made of flint, bound with lime mortar, and a half timbered superstructure. They made a working hypocaust for heating the “winter dining room” and experimented with a range of different Romano-British building options and decoration. Again, they discovered a great deal about the practicalities of life in this era, including why such a villa—representing a great departure from the old hay and clay Iron Age dwelling—should have been roofed and tiled in the high summer, as opposed to the rainy British autumn. Oh dear, how the team suffered as work was delayed and plaster failed to dry! (Morgan Evans, 2003)

Figure 14.10 A reconstructed Iron Age village at Butser, southern England.

Source: Courtesy: Dai Morgan Evans.

Overton Down One of the longest experiments in archaeological interpretation is that of the Overton Down earthwork in England’s chalk country, scene of some of the classic prehistoric excavations of the twentieth century. In 1960, the British Association for the Advancement of Science built the Overton experiment as a 128-year-long observation. The earthwork and its associated ditch were built on chalk subsoil, with profiles approximating those of prehistoric monuments. Archaeological materials—including textiles, leather, wood, animal and human bones, and pottery—were buried within and on the earthwork. The Overton Down earthwork was built partly with modern picks, shovels, and hatchets and partly with red deer antlers and ox shoulder blades in an attempt to establish relative work rates for different technologies. The difference was about 1.3:1.0 in favor of modern tools, mostly because

modern shovels were more efficient. Overton Down was then abandoned, but small and very precise excavations of the ditch and bank are taking place at intervals of 2, 4, 8, 16, 32, 64, and 128 years. The digs are used to check the decay and attrition of the earthwork and the silting of the ditch over a lengthening period. The project is yielding priceless information of great use for interpreting archaeological sites of a similar type on chalk soils (for an assessment, see Ashbee and Jewell, 1998).

Such types of controlled, long-term experiments will give us the objective data we need to understand the static archaeological record as studied in the dynamic present. They will help us evaluate our ideas about the past and answer the question of questions: not “What happened?” but “Why?”

Summary

1. Ethnographic analogy helps in ascribing meaning to the prehistoric past. Analogy itself is a form of reasoning, which assumes that if objects have some similar attributes, they will share other similarities as well. It involves using a known, identifiable phenomenon to identify unknown ones of a broadly similar type. Most simple analogies are based on technology, style, and function of artifacts, as they are defined archaeologically. Such analogies, however, based as they are on people's beliefs, can be unreliable.
2. Direct historical analogies and comparisons made with the aid of texts are common, but meaningful analogies for American and Paleolithic sites are much harder to achieve. One approach has been to devise test implications using several analogies. This technique is based on the functional approach, assuming that cultures are not made up of random traits but are integrated in various ways. Thus, analogies are made between recent and prehistoric societies with closely similar general characteristics.
3. Middle-range research is carried out on living societies using ethnoarchaeology, experimental archaeology, and historical documents. It is designed to create a body of middle-range

theory—objective theoretical devices for forging a link between the dynamic living systems of today and the static archaeological record of the past.

4. Ethnoarchaeology is ethnographic archaeology with a strongly materialist bias. Archaeologists engage in ethnoarchaeology as part of middle-range research in attempts to make meaningful interpretations of artifact patterns in the archaeological record.
5. Experimental archaeology seeks to replicate prehistoric technology and lifeways under carefully controlled conditions. As such, it is a form of archaeological analogy. Experiments have been conducted on every aspect of prehistoric culture, from lithics to housing. Archaeology by experiment provides insights into the methods and techniques used by prehistoric cultures.

Further Reading

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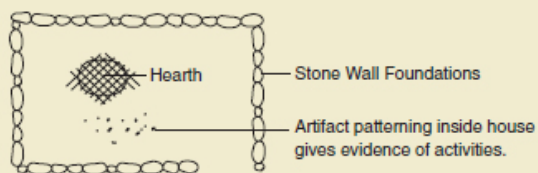
Coles, John M. 1979. *Archaeology by Experiment*. London: Heinemann.





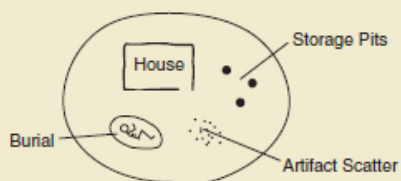






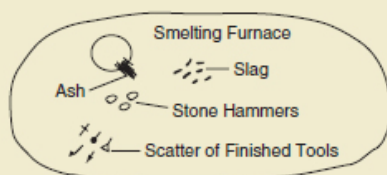
Household

(a)



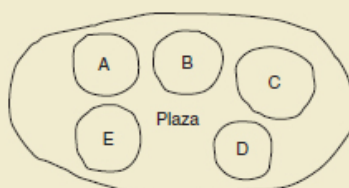
Household Unit

(b)



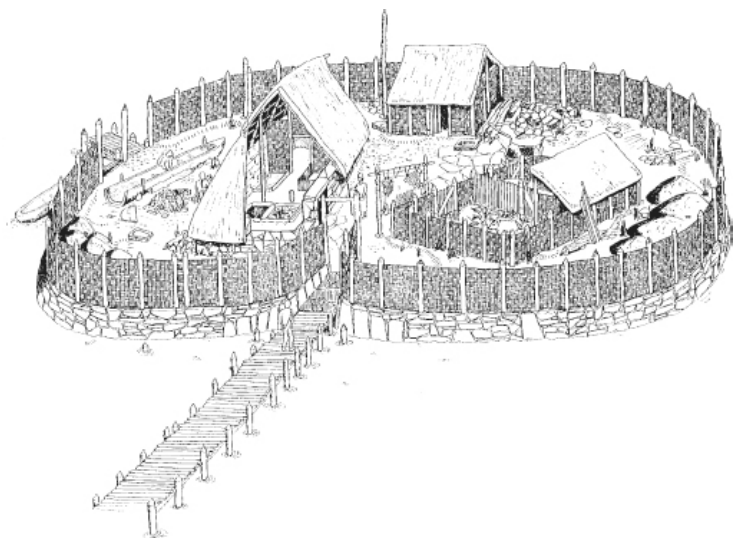
Activity Area—Smelting

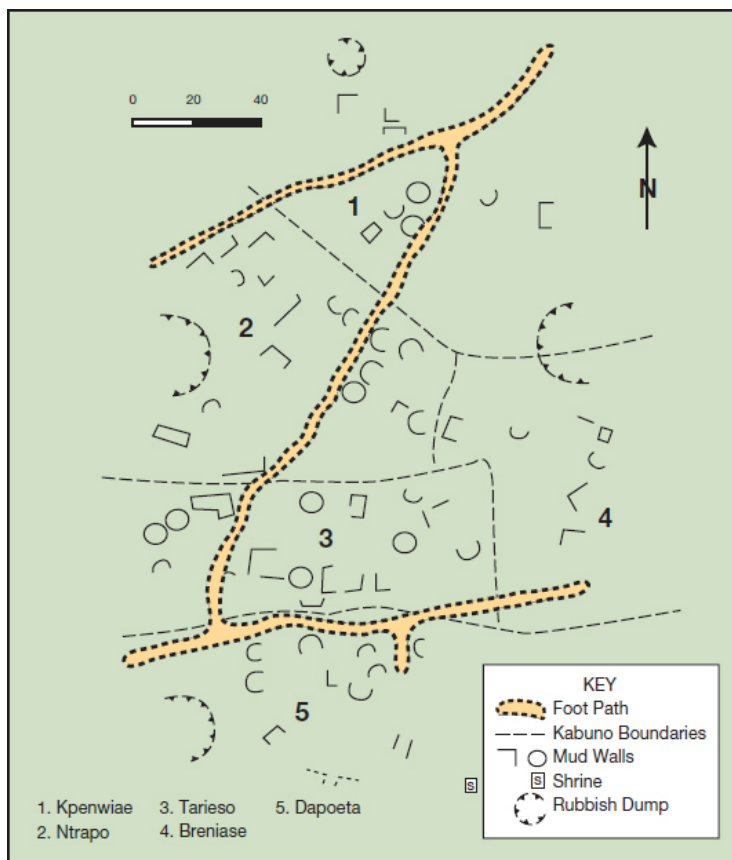
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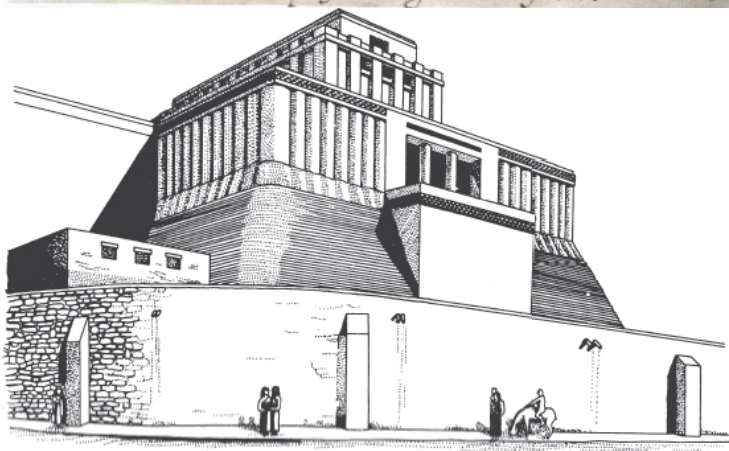


Community of Five Household Units (including activity areas)

(d)



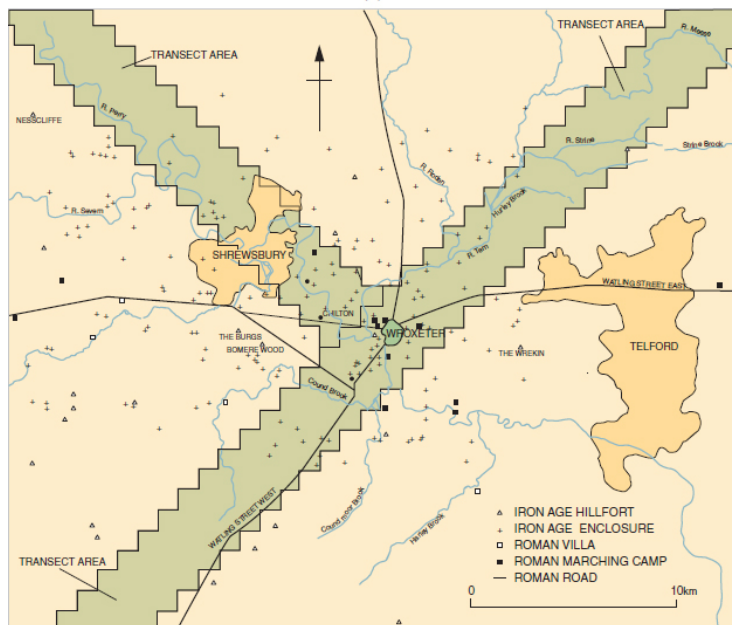


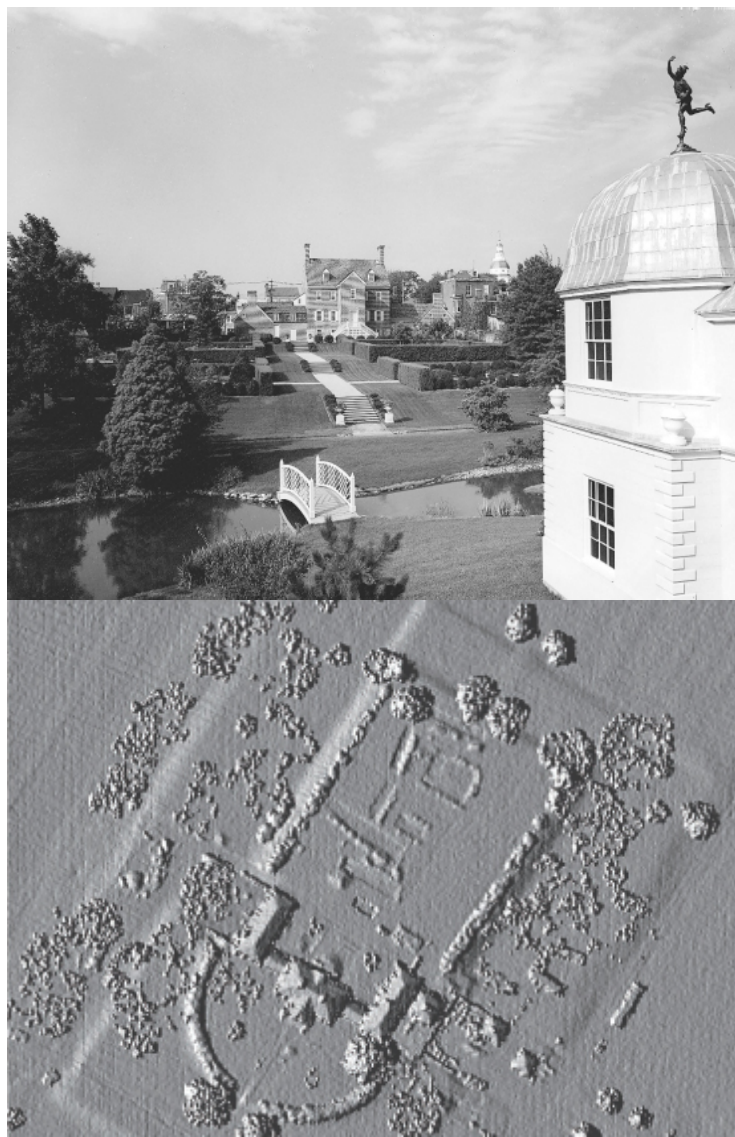






(a)





Landscape and Settlement

CHAPTER OUTLINE

Settlement Archaeology and Settlement Patterns

Households

Communities

Studying Large Communities

Studying Distributions of Communities

Case Studies of Settlement Distribution

The Archaeology of Landscape

Inca agricultural terraces at Winay Wayna near Machu Picchu, Peru.

Source: Courtesy of iStock/Thinkstock.

“I am my own aborigine,” Irish archaeologist Seamus Caulfield once commented. We were standing on the forbidding limestone cliffs of County Mayo in northwestern Ireland, gazing at the rolling bogland of Céide Fields. Caulfield grew up in nearby Belderigg, a hamlet of small houses surrounded by ancient field walls built and rebuilt over thousands of years. As a small boy, he went barefoot for six months of the year, feeling underfoot the texture of narrow pathways, marshlands, and small fields. Years later, Seamus Caulfield still has a tactile relationship with his home community and with the farmland that once sustained it, the kind of close relationship with environment and landscape once enjoyed by preindustrial societies all over the globe. He calls these familiar farmlands his “landscape of memory.” Thanks to archaeology, Caulfield has traced his ancestry back on this land to a long-forgotten Stone Age field system built before 3000 B.C.

Caulfield inherited a passion for archaeology from his schoolteacher father, who had discovered stone walls deep under the peat that mantles the local landscape. In 1983, Caulfield began to map the buried stone walls at nearby Céide Fields. First, he tried using aerial photographs to identify the field systems, but the peat covered everything. Then he turned to the low-tech tools of his youth, a 6-foot- (2 m) long iron T-bar and a special spade used for cutting peat sods.

Caulfield and his students laid out lines across the hills and ran transects of probes at 1-foot (0.3-m) intervals across the bogland. The peat was much shallower where the buried stone walls lay. Soon, hundreds of bamboo poles marked walls and fields.

Figure 15.1 Céide Fields, Ireland, from the air. The Visitors' Centre is the pyramid-like structure, surrounded by ancient fields.

Source: Courtesy of David Lyons/Alamy Stock Photo.

Season after season, Caulfield returned to Céide Fields until he had mapped more than 4 square miles (103 sq. km) of intact farming landscape, undisturbed since 2400 B.C. (**Figure 15.1**). With the help of geologists and palynologists, Caulfield showed that the warmer and wetter climate after the Ice Age brought pine forests to the area. Tree rings tell us that the forest suddenly vanished, for unknown reasons, in 2800 B.C. , opening up grassland ideal for cattle grazing. For nearly 500 years, small groups of farmers separated their pastures with low stone walls, dividing the land into a patchwork of lines, rectangles, and squares. Each family lived in a small, thatched, round house set within a stone enclosure amidst a mosaic of constantly changing fields modified over successive generations.

After five centuries, the damp climate defeated the farmers. Wet bog, with its mosses, heathers, and moor grass, spread inexorably across the hills. The grasslands vanished, the cattle herders retreated inland, and the boundary walls disappeared under peat. County Mayo was a peaceful part of Ireland. No Roman armies or social catastrophes disrupted life at Céide Fields, ensuring a high level of cultural continuity in this corner of Ireland. Seamus Caulfield's family has lived at Belderigg for generations. Thanks to his research, he feels he can safely claim himself as an "aborigine," a distant descendant of the local farmers of some 200 generations ago.

The Céide Fields project is a classic example of settlement archaeology, the topic of this chapter—the ways in which archaeologists study households, communities, and ancient cultural landscapes. Previous chapters have examined the ways in which archaeologists study artifacts and prehistoric subsistence and the various technologies that people developed to adapt to their environments, and have also

discussed some methods used to reconstruct the prehistoric environment itself. This chapter examines some of the ways in which archaeologists have studied changing settlement patterns in ancient times (David and Thomas, 2008; Kantner, 2005).

Settlement Archaeology and Settlement Patterns

Settlement archaeology is the study of changing human settlement patterns as part of the analysis of adaptive interactions between people and their external environment, both natural and cultural (Billman and Feinman, 1999). It requires a combination of a well-developed research design, common sense, archaeological survey, careful excavation, and, often, innovative remote sensing methods (see [Chapters 8 and 9](#)). Settlement patterns, the layout and distribution of human settlements on the landscape, are the result of relationships among people who decided—on the basis of practical, cultural, social, political, and economic considerations—to place their houses, settlements, and religious structures in certain ways. Thus, settlement archaeology offers the archaeologist a chance to examine not only relationships within different communities but also trading networks, resource exploitation, social organization, and cultural trends.

DISCOVERY Discovering Seascape as a Landscape of Memory: Australian Aborigines

Some of our understanding of ancient landscapes comes not only from archaeologists' own perceptions, like those of Seamus Caulfield, but also from ethnographic observations, like those of Nonie Sharp in northern Australia. Everyone associates the Australian Aborigines with deserts and arid terrain. But some aboriginal bands still dwell along the coasts of the Gulf of Carpentaria and Cape York, the closest part of northern Australia to New Guinea, which lies some 90 miles (149 km) north across the Torres Strait. Their ancestors lived this way for at least 3,000 years, and perhaps very much longer. The Aborigines' complex and intensely spiritual relationship with the sea provides a fascinating glimpse of general beliefs about the ocean that must have been widespread among coastal dwellers in the region for thousands of years

—and probably among many other ancient coastal societies as well (Sharp, 2002).

Just like other hunting and farming societies around the world, the Yolnu people of the western Gulf believe the sea is alive like a person, with angry and placid moods, a place one respects, lest it claim you. They know its rhythms, its tides and currents, the winds and waves that ruffle its surface. Everyone believes that the sea can wreak vengeance and can kill. Like hunters living far inland, they negotiate the power of their landscapes, their environment, turning threat into sacred power, invoking the strength and spiritual heft of sea creatures. The Aborigines “cooperate” with the ocean, just as they cooperate with one another, for they live with it every day. Its power is part of everyone’s body and soul. The sea journeys of sacred beings and their teachings pass down the generations in narrative, song, and ritual. These ancient values still survive as modern-day Aboriginal fishers venture into deep water or take journeys of the imagination (Figure 15.2).

Like the ancient occupants of the Asian mainland, the Aborigines of the northern coast dwell on land, but their founding figures are creator beings from the saltwater world. At one location in the Gulf of Carpentaria, the sweeping movement of a tiger shark’s tail created bays and inlets. It killed a porpoise, which turned into a rock. In this way, natural features in their homelands came into being and acquired spiritual potency. Another western Gulf group, the Yanuwa, believe they were people who originated in the sea, which means that their spiritual and cultural legacies come from the ocean. This inheritance is the law that gives them the responsibility to respect the sea and to follow the paths and marks set across the ocean landscape by ancestral figures.

[Figure 15.2 Australian Aborigines fishing off the coast of Arnhem Land, northern Australia.](#)

Source: Courtesy of Penny Tweedie/Alamy Stock Photo.

The coastal Aborigines know the patterns of movement in the ocean, the changes in wind, swell, and weather that mark the changes in seasons. They’re familiar with fish and bird migrations, with cloud formations, even luminescence in the water. They use the rising of

constellations like Orion and the Pleiades to foretell seasonal wind shifts and to track when certain fish will feed close inshore. For instance, the Pleiades appear at the coldest time of the year when the highly prized dugong moves inshore seeking warmer water. Everyone knows that Torres Island pigeons will arrive from the northwest to feed on wild plums, when the southeasters are about to die down in about September. Their knowledge extends to seemingly minor details, such as how local currents and tidal streams form roads through inshore waters, which fishers traverse on mangrove wood rafts to different fishing places.

Each group possesses kin-owned maritime territories that extend into the water, to reefs, nearby islands, and fishing grounds. These can reach offshore as far as the eye can discern and to the seabed, where the mythic Rainbow Serpent lives. Sea rights can extend far beyond the horizon, even to the outer fringes of the Great Barrier Reef. These rights, akin to land tenure ashore, are the structure for daily life along the coast, given to them by ancestral beings and passed from one generation to the next. The watery territories extend into the realm of the imagination. Just as there is the Dreaming among aboriginal peoples on land, here there is the Sea Dreaming, an equivalent that encompasses territories and paths on the sea. The practical day-to-day world and the spiritual realm intertwine in coastal Aboriginal existence, among people who are ingenious and highly adaptive, accustomed to maintaining connections with people living at a distance, either on land or across water. Everywhere along the coast, people live amidst “seascapes of memory,” amidst seascapes that are alive, at one with human actors.

Human settlements are not randomly distributed across the landscape. If you find certain kinds of settlements near water sources, trade routes, food resources, or easily defended areas, you can reasonably assume that there were sound, practical reasons behind the site distributions. Within the villages themselves, a complex variety of cultural, social, and even personal factors dictated the layout of houses in relation to one another. For instance, the Chumash Indians of southern California lived on the islands and shores of the Santa Barbara Channel, where ocean upwelling nourished one of the richest inshore fisheries on the earth. This rich, if unpredictable, bounty of marine

resources allowed Chumash hunter-gatherers 700 years ago to live in densely populated, permanent settlements with as many as 1,000 inhabitants. The most important of these villages clustered at sheltered spots on the coast that had good canoe landings, kelp fisheries close offshore, and sea mammal rookeries within easy reach—all important considerations in terms of Chumash subsistence.

Figure 15.3 The central precincts of the Maya city at Tikal, Guatemala, dating to about A.D. 700. The temple pyramids are replicas in stone and stucco of sacred mountains.

Source: Courtesy of [Ablestock.com/Thinkstock](https://www.ablestock.com/Thinkstock).

At another level, an entire village or city may reflect a society's worldview. The ancient Mesoamericans placed great emphasis on lavish public ceremonies set in the heart of large ceremonial centers. Great lowland Maya cities such as Copán and Tikal 1,500 years ago were replicas in stone and stucco of the layered Mesoamerican spiritual world of the heavens, the living world, and the underworld (**Figure 15.3**). Their pyramids were sacred mountains; the doorways of the temples atop them were the sacred openings by which the ruler, as intermediary with the spiritual world, traveled to the Otherworld up and down the Wacah Chan, the symbolic World Tree that connected the layers of the Maya universe. The Aztec capital, Tenochtitlán in the Valley of Mexico, was the symbolic hub of their world (**Figure 15.4**).

The relationship between an individual and the landscape can be as complex as that of an entire society. A Central African farmer works a patchwork of small gardens, some intensely cultivated, others lying fallow as the soil regenerates after years of use. The casual observer might see very little, but to the farmer there are the subtle signs of regenerating soil, grasses to be eaten by his cattle in the weeks ahead, and flowering nut trees that come into harvest at the end of the wet season; the landscape is a quilt of gardens, plants, and animals protected by his ancestors, who are the spiritual guardians of the land.

Settlement archaeology is about these many layers of dynamic relationships, some of which are nearly impossible to discern without the careful use of analogy with living societies (see **Chapter 14**). For instance, we know from modern analogies in Africa and New Guinea

that village layout may be determined by the need to protect one's herds against animal predators or war parties. Other settlements may be strung out at regular intervals along an important trade artery, such as a river. Even the positioning of individual houses is dictated by a complex variety of social, economic, and personal factors that can defy explanation.

The determinants of settlement patterns operate at different levels, each formed by factors that differ in quality and degree from the ones that shape other levels:

1. *Buildings and Activity Areas.* Houses, buildings, and activity areas are minimal units of archaeological settlement analysis.
2. *Communities.* The arrangement of houses and activity areas into a single group constitutes a community. The term community is defined as a maximal group of persons who normally reside in face-to-face association.
3. *Distribution of Communities.* The density and distribution of communities, whatever their size, are determined to a considerable extent by the natural resources in the environment and by the nutritional requirements, technological level, and sociopolitical complexity of the population, as well as by social and religious constraints.

The ultimate objective of the exercise is to study ancient settlement systems as an aspect of the whole picture of an ancient society. In this connection, “off-site” features, such as field systems, are also of great importance in providing insight into the full range of past human activity.

Figure 15.4 The central precincts of the Aztec capital, Tenochtitlán, with the temple of the sun god Huitzilopochtli and the rain god Tlaloc at right. The central plaza was the axis of the Aztec universe.

Source: Courtesy of National Geographic Image Collection/Alamy Stock Photo.

Households

Households are homes, dwellings, or residences where people lived.

Meticulous excavation can reveal the activities of individual households, provided the house has remained isolated from surrounding household activities and undisturbed by more recent occupations or natural processes. Archaeologically, households may be represented by structural remains, as well as by artifacts and features left by the households' residents. These materials may include clearly delineated activity areas, areas where a specific activity—such as stone toolmaking, craft activities, or food processing—took place. Remains of houses, disintegrating walls, the distribution of hearths, stone grinders, and other artifacts abandoned when the owners left can be used to reconstruct the activities of individual households.

Archaeological sites, whether small hunting camps, humble farming villages, or vast cities, are archives of human interaction. A household unit is defined by the artifact patterns that reflect activities that take place around a house; they are assumed to belong to one household. People lived and died in these places. They grew up, got married, had children, and quarreled with neighbors. These daily interactions between men and women, rich and poor, traders and their customers, slaves and masters come down to us in the form of distinctive artifact patterning. The anonymous testimony of artifacts from individual houses, neighborhoods, palaces, and temples reveals the full, and often unsuspected, diversity of ancient human communities.

Sometimes, archaeological preservation may provide unique insights into household life. For example, 1,700 years ago, the Romans controlled the Mediterranean world and its lucrative trade routes through a network of cities and ports from Spain to Egypt. On July 21, A.D. 365, an early-morning earthquake ripped through a small Roman port at Kourion in southwestern Cyprus. Three shock waves flattened the town. The quake caused huge tsunamis that rolled ashore in the eastern Mediterranean. Archaeologist David Soren recovered a treasure trove of information about the households in Kourion by excavating the individual buildings and plotting the artifacts of daily life preserved in the collapsed dwellings (Soren and James, 1988). He recovered the skeletal remains of a family still abed. The husband died vainly trying to shield his young wife and infant from a rain of beams and limestone blocks ([Figure 15.5](#)). In a nearby courtyard, Soren's excavators found a stable where a young girl died trying to calm a restless mule, whose

skeleton lay by a stone trough.

Figure 15.5 Earthquake victims at Kourion. A family died while sleeping, the child clasped in the mother's arms.

Source: Courtesy of National Geographic Image Collection.

Fortunately for the archaeologist, individuals within different societies tend to use similar construction methods and build their houses in similar ways, so researchers can use the variations in house designs and artifact patterning between houses as evidence for different subsistence practices, social status, wealth, and manufacturing activities. Like a shipwreck on the seabed, a well-excavated ancient house can be a time capsule of a single moment, which an expert can read just like a book.

Excavating a Household

When a house is excavated, the objective is to try to define the entire household unit, comprised not only of the dwelling itself but also of any surrounding storage pits, graves, and activity areas indicating food preparation and other tasks associated with a household (see [Figure 15.6](#)). Kourion is a dramatic find, and individual households were preserved by the very cataclysm that destroyed them. More often, the archaeologist finds more subtle patterning of household activities; indeed, in the majority of cases, identifying even faint traces of timber and hide shelters or evidence of ancient mud walls may be impossible. Households require careful, large area excavations so that all traces of the household and any surrounding features can be identified. Archaeologists plot the exact position of each artifact, bone, and feature where they lie, in the hope of finding evidence of stone toolmaking, cooking, or domestic crafts preserved within the boundaries of long-vanished dwellings. Household archaeology is a classic application of the law of association, described in [Chapter 6](#).

The distinctive patterning of artifacts in houses, storage pits, and other areas forms activity sets, groups of artifacts associated with specific activities, such as wire-making tools and copper rods indicating the manufacture of fine copper wire ornaments. Sometimes, evidence of past activities can be determined while excavation is still in progress—

stone-tool manufacture surviving as a scattering of waste flakes and cores, or the butchering of a rabbit by a cluster of broken bones. More often, however, computer analysis is the best source of information, allowing researchers to call up the position of every potsherd of a certain style or all ox forelimb bones. It is then that they can discern unexpected associations, subtle signposts of long-forgotten domestic activities or even of children playing. This type of excavation is invaluable when studying male and female roles or the cultural diversity of a household revealed by distinctive artifacts. Short of a burial or a house belonging to a known historical individual, this is about as close as one can get in archaeology to discerning individuals, as opposed to households (see [Figure 15.7](#)).

Households at Cerén, San Salvador

Activity sets sometimes provide startlingly complete stories of the past, especially at sites where preservation conditions are exceptional. One August evening in the sixth century A.D. , a sudden rumble shook a quiet Maya village at Cerén in El Salvador (see also [Chapter 4](#)). An underground fissure less than a mile away erupted without warning. A fast-moving cloud of ash darkened the twilight sky. The villagers fled for their lives, leaving everything behind. In minutes, their houses lay under a thick layer of volcanic debris. Archaeologist Payson Sheets (1992), 1,500 years later, used subsurface radar (see [Chapter 8](#)) to locate several buried houses deep under the ash. He then excavated the dwellings. Plotting every artifact—even individual wall fragments, seeds, and pieces of thatch—he discovered households from which the people fled the cascading ash at the end of the evening meal.

Figure 15.6 Various spatial units used by archaeologists in studying human settlement: (a) household; (b) household unit; (c) activity area; (d) community.

One household lived in a complex of four buildings: a kitchen, a workshop, a storehouse, and a residence, where the residents socialized, ate, and slept (see [Figure 4.10](#) on page 75). The residence had a front porch open on three sides. The main room covered 43 square feet (4 sq. m), with storage pots against the back wall. One pot contained a spindle whorl for making cotton thread. A large adobe bench on the east side of

the room served as a sleeping place. During the day, people rolled up their mats and stored them among the rafters. Even the sharp-edged obsidian knife blades, stored high in the roof for safety, still lay among the thatch.

A walkway linked the dwelling to a nearby storehouse, passing by a food-grinding area where a metate (grinding stone) still stood on forked sticks about 20 inches (50 cm) above the ground. The household owned a well-tended garden along the side of the storehouse, with carefully spaced rows of three species of medicinal herbs standing about 3 feet (1 m) apart, each plant standing in a small mound of soil. Just to the south, an ash-covered field contained ridges of young maize plants about 8–15 inches (20–38 cm) high, typical corn growth for August in this environment.

At Cerén, as at all other settlements, complex factors affected the layout of houses and entire communities (see the Site Box).

Communities

Communities are the arrangement of houses and activity areas within a single settlement: a group of individuals and households who normally reside in face-to-face association. Communities cover the vast spectrum of human settlements, from tiny hunter-gatherer camps to enormous cities. Expanded versions of the same survey and excavation methods used to investigate individual households operate at the community level, but a researcher's concerns range far wider than individual household activities and the layout of the settlement itself. Both environmental conditions and subsistence constraints limit the size and permanence of human settlements (see [Figure 15.9](#)). Most hunter-gatherer societies, such as the !Kung San of southern Africa's Kalahari Desert or the Hadza of Tanzania, East Africa, are constantly on the move, so their camps are short-lived, sometimes occupied for little more than a few days. In contrast, the farmers of Çatalhöyük, a Turkish farming settlement of 6000 B.C. , lived in the same crowded village of mud houses separated by narrow alleys for many centuries because they were anchored to their nearby fields (Hodder, 2006). (See [Figure 3.6](#) on page 56.)

Figure 15.7 Plan of a house at Tierras Largas, Valley of Oaxaca, Mexico, from around 900 B.C. , with selected artifacts plotted on the floor. The excavator, Marcus Winter, broke the house's contents into at least five possible activities, including sewing and basketry (needles), cooking and food consumption (pots and food remains), and cutting and scraping (stone tools). He plotted the house contents in an attempt to distinguish the craft activities of the occupants and, perhaps, to identify division of labor within the household.

Communities are never static entities. Children grow up, marry, and start new households nearby. Houses burn down or collapse, so new dwellings are built in their place. As often happened with Iroquois villages in the American Northeast, a settlement would outgrow its fortifications and then erect an extended palisade to protect new houses. The study of an ancient community is a study of constant interactions among individuals, households, and members of the settlement.

Examples: Keatley Creek and Bridges

When archaeologist Brian Hayden (1996) excavated a series of large Native American winter houses at Keatley Creek near the Fraser River in British Columbia, he unearthed over 115 house depressions, excavated partially into the ground, some over 66 feet (20 m) across (see [Figure 15.10](#)). The dwellings were dug up to 6 feet (2 m) into the subsoil, then roofed with timber, bark, grass, or mats. Access was usually by ladder through the smoke hole. The site lies on a dry terrace above the Fraser River in a semiarid environment. Mountains rise behind the site. There are a number of important salmon-harvesting sites nearby, which were among the most productive in the region in early historic times. Many surrounding groups came to the area to trade for dried salmon, which probably gave Keatley Creek unusual importance as a settlement.

S i T E > Marki, Cyprus: Negotiating Space <

Studying households requires not only meticulous excavation but also a careful look at the social changes behind changes in dwellings and in entire communities. Few field projects have achieved this, but an excavation on Cyprus in the eastern Mediterranean is a step in the right direction. The Bronze Age village at Marki was occupied for between

500 and 600 years after 2400 B.C. During these five or six centuries, the village grew from a community of a few households into a much larger 15-acre (6 ha) settlement with narrow alleys before declining and then being abandoned. The maximum population was about 400 people. Marki was both a self-sufficient farming community and a copper mining settlement, exploiting outcrops in the nearby Troodos Mountains. David Frankel and Jennifer Webb (2006) have excavated about 21,500 square feet (2,000 sq. m) of the settlement, which enabled them to study the changing ways in which the inhabitants used the space available to them (Figure 15.8).

The excavators identified 33 compounds, which they consider separate households. Some were in use for centuries, others for shorter periods of time. Most of the compounds were rectangular courtyards with small, enclosed rooms built of mudbrick on stone foundations. The rooms had plaster wall benches, hearths, and clay ovens; narrow alleys linked the houses. Most of the compounds were remodeled and renovated, partly because mudbrick buildings decay relatively quickly. Typically, the builders would tear down the mudbrick walls and rebuild on the existing foundations, which were constrained by the dimensions of the compound. Frankel and Webb were able to subdivide Marki into nine phases, each representing what they call “a palimpsest,” each of perhaps three generations of activity. Throughout the settlement’s history, each household lived in a rectangular courtyard with covered rooms at the back. There was nothing in the houses or the artifacts associated with them that hinted at different wealth levels between households. The inhabitants never followed a master plan for the community over many generations. Compounds were added haphazardly and cumulatively. As time went on, the population increased, with a continual process of negotiation over space under way. The village, once a hamlet of freestanding structures, became a tightly packed, built-up area with relatively little open space and limited access to individual compounds.

The cycles of rebuilding and renovation of dwellings occupied over long periods clearly suggest that houses were inherited by each generation from its predecessor, remaining occupied by well-established families. Two compounds in particular maintained their boundaries for three or four centuries and may have exercised considerable authority

as a result. One of them even maintained an offshoot household, which was interconnected to it for several generations before becoming larger and finally becoming a separate compound.

While many details of the negotiations that accompanied the enlargement or subdivision of household spaces will always elude us, some general trends are notable. There was a move toward greater privacy, both within compounds and houses, reflected by the full enclosure of compounds, also the eventual separation of sets of compounds from one another.

During the earliest generations of the settlement, the inner rooms of compounds faced into a minimally enclosed courtyard in which a wide range of activities took place. This implies a high degree of social and economic cooperation between individual households in a tiny community of about 40 people. Within a century or so of first settlement, self-contained households came into being, now secure enough to survive as individual economic units. By this time, population increases and larger families may have led to each maintaining its own dwellings and land. But the one adjoining compound suggests that there was an increasing emphasis on extended family relationships.

Marki reflects the kinds of profound economic and social changes that can be identified through careful excavation of individual households within a small community. After generations of constant interaction between everyone in the community, a more impersonal village developed, where people tended to live in enclosed compounds and knew well only the people in their own neighborhoods. Simultaneously, new mechanisms for social control may have developed at Marki, which involved such intangibles as ties of kin and obligations between members of extended families. We will never know.

Figure 15.8 The Bronze Age village at Marki, Cyprus, showing the closely packed household compounds.

Source: Image from David Frankel.

Most of the house pits excavated by Hayden and his colleagues date to between 3500 B.C. and A.D. 950. The workers excavated each house pit

carefully, recording not only the basic dimensions but also the sizes of hearths and storage pits and the depth of fire reddening beneath each hearth. Using fine screens, they acquired as much accurate information on the positions of individual artifacts and food remains as possible. In addition, they sampled house-floor deposits for their soil chemistry and used flotation to recover small plant remains, tiny artifacts, and bone fragments. They combined these data with sourcing studies of toolmaking materials (see [Chapter 11](#)), and studied ways of distinguishing floor surfaces from the remains of collapsed thatched roofs.

The analysis of all these data revealed some interesting social differences. One large pithouse had a series of hearths forming a circle about 6 feet (2 m) from the pit wall, as if a series of domestic groups had resided in the same dwelling. Each hearth had its own fire-cracked rocks and stone tools used for domestic activities. The distributions of stone artifact fragments and waste by-products revealed that messier tasks such as animal butchery and spear making had taken place in the center of the dwelling, where there was more space and headroom. Activities such as projectile-point manufacture and sewing had occurred in the domestic areas, which were more comfortable.

[Figure 15.9 Environment and community: an adaptation to cool, damp conditions. An artist's reconstruction of a Neolithic house and associated structures from a small settlement at Loch Olabhat, Hebrides, Scotland. A wooden causeway leads through a narrow entrance. The house is at left, cut away to show the hearth inside. The artist has conveyed the excavators' uncertainty about the function of the structure to the right with masterly ambiguity.](#)

The layout of hearths in the same house revealed another interesting pattern. The deeper, more fire-reddened hearths were in the western area of the dwelling, and the smaller and more superficially reddened ones were to the east. By the same token, the larger storage pits were also to the west. Hayden believes that these patterns reflect not separate activity areas but socioeconomic variations between wealthier, more powerful people living by the larger hearths and pits and poorer families located elsewhere.

The Keatley Creek excavations revealed possible evidence for social

organization, but other lines of evidence were needed to confirm the hypothesis. In fact, other excavations on Northwest Coast houses and ethnographic accounts from living groups support Hayden's theory, for they reveal large dwellings where the richer and more powerful families occupied one-half of the house.

Ethnographic accounts report that the most important fishing sites in the region were owned by members of individual households, perhaps passed down from one generation to the next. Ken Berry's analysis of the salmon bones from Keatley Creek revealed that poorer families consumed mostly "pink salmon," readily identified by the two-year growth rings in their backbones. Pink salmon are the easiest to catch, but they are the smallest and have the lowest fat content. In contrast, the inhabitants of the larger dwellings ate not only pink salmon but also chinook and sockeye salmons, larger forms that could be caught in quantity only from rocks projecting far into the water or from specially constructed platforms. The fact that such salmon bones are found only in larger houses strongly confirms ethnographic accounts that only a few families or kin groups owned such sites. Salmon provided over 70 percent of the protein in the local diet. Dried fish was traded widely in historic times and, presumably, earlier; it was a trade controlled by elite families, who retained others, both commoners and slaves, to do the monotonous fishing and processing work.

Figure 15.10 The Keatley Creek site, British Columbia, showing house depressions.

Source: Image from Brian Fagan.

Finally, archaeologist Ed Bakewell studied the sources of the toolmaking chert found in the large house pits. Each such dwelling had its own distinctive source, or a constellation of sources that it drew on, as if they had formed separate economic entities, each exploiting its own stone sources and hunting grounds in the mountains. Furthermore, analysis of the stone tools in the middens along the rims of the house pits revealed remarkably little change over the long duration of the site, as if the same corporate groups had exercised control over local fishing rights and their own territories for more than 1,000 years. Hayden claims that this is the longest-lived example of such economic and

social stability known anywhere.

The Keatley Creek excavations are a good example of the ability of fine-grained excavation to reveal long-term social and economic relationships. However, the use of artifact distributions to infer human activities is challenging.

Archaeologists frequently use analogies with modern populations and theoretical models to help them conceptualize life in past settlements. Gerald Oetelaar (1993) studied site structure at the Bridges site, a late Mississippian settlement in southern Illinois occupied between A.D. 1100 and 1300. To better understand activities within the settlement, he developed a research model that subdivides small settlements into four major activity zones: a communal front region for public activities; family front and back regions for domestic tasks, entertainment, and messy tasks; and a communal back region (see [Figure 15.11a](#) and [Figure 15.11b](#) on page 299). These diverse activities generate different debris, the model providing an analytical framework for inferring the organization and use of space at the site. Oetelaar argues that the model shows long-term stability at the settlement, the large communal areas depicting a degree of collaboration among different families, perhaps at planting and harvest seasons. Models like this allow researchers to study the interactions among households within the confines of a single site, and may also enable the identification of specific activities at individual settlements within a larger settlement pattern.

Ethnoarchaeology at Wiaae, Ghana

Ethnoarchaeology, the ethnographic study of material culture with particular relevance to the interpretation of archaeological remains, also helps archaeologists to model the types of variables that impact the arrangement and distribution of settlements. Examinations of modern communities reveal a diversity of sociocultural, economic, and political variables that dictate how people arrange their communities. These are of particular help in interpreting archaeological sites associated with the ethnographically observed population. They also provide general insight into the types of factors that might impact the arrangement of communities.

The potential of ethnoarchaeological research is illustrated by the work conducted over the past twenty years by E. Kofi Agorsah on sites relating to the Nchumuru people of Wiae, in the northern Volta Basin of Ghana (Agorsah, 2003). Agorsah was interested in examining the sociocultural factors that come into play in the arrangement of Nchumuru settlements. He was fortunate in having a very rich material record to study. The site of Old Wiae burned, and the people moved to New Wiae, which is still occupied. Agorsah was thus able to compare archaeological data from Old Wiae with ethnographic observations at the new town (Figure 15.11).

Agorsah found that spatial arrangements within the communities were dictated by a number of local rules, particularly family organization and clan membership. Archaeologically, the ethnographic observations were born out in discrete clustering of houses within settlements reflecting the different Nchumuru clan groups. Ancestral shrines associated with each clan were located near the houses of clan heads. Individual household units incorporated houses with at least two rooms, a courtyard, kitchen, and backyard. Typically, these areas served a diversity of functions, including food processing and preparation, sleeping, and storage, but some differences could be identified. For example, older women's rooms were marked by a raised platform bed and smaller platforms along the walls for holding pots. The only areas that had a clearly specialized function were those that held household shrines.

Agorsah's observations of the Wiae settlements are very useful in examining archaeological data from Nchumuru archaeological sites, as well as those of neighboring ethnic groups that share similar sociocultural practices. At a more general level, however, such observations help archaeologists think about the types of factors that might be reflected in archaeological data, allowing them to evaluate cultural processes in past societies.

Figure 15.11 Map showing clan (kabuno) areas of Old Wiae. Ethnoarchaeological studies such as these provide clues to material aspects of social organization that may be present in archaeological sites.

Source: Reprinted from *Journal of Anthropological Archaeology* 7: 231–247, Figure 15.2, page 239. Copyright © 1988, reprinted with permission from

Estimating Community Size

Implicit in the preceding discussions is variation in settlement size. Community population estimates are important because they can give insights into resource exploitation, past sociopolitical organization, and social dynamics. What, for example, was the maximum size that early Mesoamerican hamlets and villages could reach before further growth was impossible? Typically, societies that were not organized into large states tended to live in small villages, which frequently split off from one another as further growth at the mother settlement was cut off. This process is straightforward enough, and in early Mesoamerica, many villages split off in just this manner. But others, such as the Olmec settlement at San Lorenzo, one of the earliest ceremonial centers in the Mesoamerican lowlands, were able to grow larger and still remain viable settlements. Why was this growth possible?

How does one estimate community populations? In historically documented settings, written records, or even census data, may provide fairly accurate population estimates, as in sixteenth-century Algonquian villages (see [Figure 15.12](#)). Using analogy, such information can sometimes be applied to archaeological settings—the size, number, and layout of the known settlement used to evaluate the relative size of excavated communities. In most cases, however, written records are not available or are of uncertain value. Many variables might contribute to erroneous census data, and historic population densities and household sizes do not necessarily correspond to those of prehistoric times.

Figure 15.12 An example of a community. Algonquian village in North Carolina, sketched by John White in 1585.

Source: Courtesy of Granger Historical Picture Archive/Alamy Stock Photo.

For the most part, researchers must turn to archaeological data to evaluate population. The most reliable estimates of population are obtained when fairly accurate assessments of the number of households at any one moment in a community's history can be determined. René Millon's guesses about Teotihuacán's population, for example, are based on such house counts (Millon, 1981). Using samples of early

Mesoamerican villages, Joyce Marcus (1976) also showed that perhaps 90 percent were small hamlets with 1 to 10 or 12 households and up to 60 people. But some villages were much larger than this average.

The relative areas occupied by a settlement provide some indication of population, and some researchers have attempted to estimate population sizes with mathematical formulas that allocate so much living space to each individual and each family. But population density within settlements varies. Consequently, the relationship between settlement size and population is not constant. Theoretical models can provide important insight into the relative size of settlements and relative population growth within a region, but intangible variables—ranging from idiosyncratic behavior to social restrictions and cultural norms—make it difficult to develop a standard.

Estimates of the rates at which people accumulate refuse middens or densities of ceramic sherds over long periods have also been used to calculate population size, but these approaches have the same limitations as the others mentioned (Zubrow, 1976). For these reasons, archaeological assessments of population are guarded, with a clear statement of the criteria used in reaching a conclusion.

Studying Large Communities

The behaviors and interactions of people living in large communities such as cities raise special challenges. Whereas subsistence needs and environmental realities often affect the siting of smaller communities, more complex factors, such as religious authority, sociopolitical organization, and status differences, come into play with ancient cities. For example, the city of Eridu in southern Iraq was the largest human settlement on the earth in 4000 B.C. Eridu lay close to the Euphrates River, with easy access to the wider world of the Persian Gulf. Approximately 5,000 people clustered in the crowded precincts of the city, perhaps, at first, little more than an agglomeration of villages of close kin or specialist artisans living close together for mutual protection and economic interest. They lived in the shadow of the great mud-brick ziggurat temple-mound of the god Enlil, a veritable artificial mountain that reached toward the wide heavens above (Postgate, 1993) (Figure 15.13). Eridu's temple was the highest point in the flat

countryside for many miles around, a symbol of a very sacred place favored by the gods. Compelling political and religious factors helped determine the site of Eridu, the chosen city of Enlil. As were many other ancient cities, this oldest of human cities was a symbolic center of the universe, the holiest place on the earth.

Figure 15.13 Reconstruction of the temple at Eridu, Iraq, showing the platform supporting the shrine, circa 3000 B.C.

Teotihuacán, Mexico

We tend to think of ancient cities in terms of their signature public structures—palaces, pyramids, and magnificent temples. But archaeology allows us to look far beyond the lavish façade and huge plazas into a humbler world. The city of Teotihuacán, at the edge of the Basin of Mexico, was a cluster of villages in 250 B.C. Over the next two centuries, the villages became a city of an estimated 40,000 people (Millon, 1973, 1981). Five hundred years later, between 100,000 and 200,000 nobles, artisans, and common folk dwelt within its precincts, which covered 7 square miles (18 sq. km) (Figure 15.14). Teotihuacán had become rich on obsidian trade, and it was a place of sacred pilgrimage ruled by powerful lords. In its heyday, the city dwarfed medieval London with its few tens of thousands of citizens and was one of the largest human settlements in the world. Then, in about A.D. 750, Teotihuacán abruptly collapsed for reasons that are still not understood. The Aztecs still revered its sacred pyramids eight centuries later. They believed that Teotihuacán was the place where their world began.

As we saw in [Chapter 8](#), archaeologists René Millon, Bruce Dewitt, and George Cowgill undertook the ambitious task of mapping the entire city of Teotihuacán in the 1960s. They showed that, unlike many cities, Teotihuacán had not grown haphazardly. Mapping revealed that the city's architects had worked to a layout devised early in the city's development and had adhered to it for centuries. For its entire existence, Teotihuacán was a model in clay, stone, and stucco of an all-pervasive spiritual world. This brilliant conception was a symbolic landscape of artificial mountains (pyramids) and foothills separated by open spaces.

The archaeologists found that the city had been built in four

quadrants, according to the master plan that had been established by the original architects. The famous Street of the Dead bisects the city on a north–south axis, bordered on its east side by the 200-foot-high (61 m) Pyramid of the Sun, built in five stages over a natural cavern discovered during excavations in 1971. This cave was the most sacred place in the city, a gateway to the otherworld. The pyramid itself marked the passage of the sun from east to west and the rising of the Pleiades constellation on the day of the equinox. An east-west avenue crosses the Street of the Dead near its southern end, dividing the city into segments coinciding with the four quadrants of the Mesoamerican spiritual world. This basic cruciform layout was established very early, when the great Street of the Dead was laid out (Cowgill et al., 1984) (Figure 15.15).

Thanks to the mapping project, we know that teeming neighborhoods of single-story, flat-roofed, rectangular apartment compounds complete with courtyards and passageways lay beyond the ceremonial precincts. Teotihuacán's population may have reached a peak of more than 150,000 people in A.D. 600. More than 2,000 compounds contained thousands of standardized, one-story apartments sharing courtyards and temples with their neighbors. The oldest part of the city lies in the northern quadrant, where most of the city's craftspeople lived. It contains many more structures than the southern quadrants, where exceptionally fertile soils, ideal for irrigation agriculture, are located.

Figure 15.14 The Pyramid of the Sun at Teotihuacán, Mexico. The Street of the Dead runs in front of the pyramid.

Source: Courtesy of Arthur Greenberg/Alamy Stock Photo.

Figure 15.15 Looking down the Street of the Dead at Teotihuacán, Mexico.

Source: Courtesy of iStock/Thinkstock.

Teotihuacán was a vast urban community made up of hundreds of smaller communities. The city was organized into neighborhoods, or barrios, groups of apartment compounds separated from one another. Some of these compounds contained large concentrations of obsidian flakes or potters' artifacts and were identified as specialist precincts or

groups of workshops. Narrow alleyways and streets about 12 feet (3.6 m) wide separated each compound from its neighbors. Each compound housed between 20 and 100 people, perhaps members of the same kin group. Artifact patterning indicates that some compounds sheltered skilled artisans, families of obsidian and shell ornament makers, weavers, and potters.

The Teotihuacán market sold commodities and exotic luxuries from all over the Mesoamerican highlands and lowlands. The Teotihuacáños valued their foreign trade so highly that they allowed foreigners to settle among them in special barrios occupied over many centuries. Immigrants from the Veracruz region of the lowlands lived in a neighborhood on the city's eastern side, identified from the remains of distinctive circular adobe houses with thatched roofs identical to those of the inhabitants' Gulf Coast homeland. These people, easily identified by their orange-, brown-, and cream-painted pots, probably traded in exotic tropical luxuries such as brightly colored bird feathers. Another neighborhood on the western side housed Zapotec traders from the Valley of Oaxaca, 250 miles (400 km) south of Teotihuacán. Potsherds from their segregated compounds allow us to identify their presence in the crowded city.

What was life like inside Teotihuacán's anonymous apartment compounds? Mexican archaeologist Linda Manzanilla has investigated one such barrio close to the northwestern edge of Teotihuacán, searching for traces of different activities within the complex. The stucco floors in the apartments and courtyards had been swept clean, so Manzanilla and her colleagues used chemical analyses of the floor deposits to search for human activities. She developed a mosaic of different chemical readings, such as high-phosphate readings where garbage had rotted and dense concentrations of carbonate from lime (used in the preparation of both tortillas and stucco) indicated cooking or building activity. Manzanilla's chemical plans of the compound are accurate enough to pinpoint the locations of cooking fires and eating places, where the inhabitants consumed deer, rabbits, and turkeys. She was able to identify three nuclear families totaling about 30 people who lived in three separate apartments within this community inside a much larger community. Each apartment had specific areas for sleeping, eating, religious activities, and funeral rites.

A major objective of the Teotihuacán research is to understand the diverse internal workings of this remarkable city as an ongoing organization throughout its long history. This result can be achieved only by comprehensive surveys that rely heavily on samples of artifact patterns and analyses of house contents and entire neighborhoods conducted all over this enormous site.

Archaeological work at Teotihuacán has revealed the human interactions within and between its tight-knit barrios and the wider universe of the city itself. Today, Teotihuacán is an archaeological skeleton. However, thanks to the mapping project and later researches, we can easily imagine the city in its heyday 1,500 years ago, the brightly painted ceremonial precincts lapped by thousands of flat apartment roofs and the city surrounded by a green patchwork of irrigation canals and cornfields (Berrin and Pasztory, 1993).

Studying Distributions of Communities

The explanation of evolving settlement patterns takes us to a broader area of research, the layout of communities against the entire background of their natural and cultural environments. The distribution of communities, the density and spatial patterning of communities across the landscape, depends on many factors. Some are environmental, such as the availability of game, wild plant foods, or good grazing grass; but some settlement patterns are influenced by economic, social, religious, and technological constraints. Settlement patterns across a landscape evolve in response to three broad variables: shifts in population density, environment, and sociopolitical phenomena.

Population

Of the variables that affect site distribution, population is the hardest to study (Hassan, 1981). Nevertheless, changing population distributions are of great importance, for there is a clear cause-and-effect relationship between population, carrying capacity, agricultural productivity, and sociocultural organization. Global population growth was likely not a major factor in human history until after the Ice Age, which ended

about 15,000 years ago. Until that time, naturally occurring plant and animal resources provided sufficient food for hunter-gatherer populations. If the size of a community grew beyond the resources locally available, people simply expanded into new areas. As population increased, some theorize, people turned to new fishing or hunting methods and, ultimately, agriculture.

Growing population densities following the Ice Age were probably a factor in the development of agriculture in southwestern Asia in about 10,000 B.C. , and in the appearance of the first cities and civilizations about 6,000 years later. In the case of farming, much drier conditions, diminished supplies of wild plant foods, and many more mouths to feed turned many hunter-gatherer groups in the Jordan Valley and modern-day Syria into sedentary farmers within a few centuries. Farmers faced the challenge by developing large-scale irrigation systems capable of producing several crops a year and feeding many more people.

Population, then, is a critical variable in settlement archaeology. Even indicators of general trends are of great interest, for they enable one to monitor large-scale processes such as major changes in subsistence strategies, sociopolitical change, and the rise or fall of entire civilizations. Unfortunately, as seen in the discussion of settlement size, estimating population densities is challenging, despite attempts to develop censuses from house counts and refuse accumulation.

Carrying Capacity and Site-Catchment Analysis

Cultural adaptation to any environment can be understood only in the context of the ancient environment, the resources available therein, and the technology of the culture being studied. Once these data are on hand, the archaeologist can proceed to establish which subsistence and economic options the people chose, given the available resources and their technological ability to exploit them.

It is easy enough to make an inventory of the natural resources in any area, but it is not sufficient merely to list them, for it is the ways in which they can be exploited—the seasons of availability of vegetable foods, the migration patterns of game, the months when salmon runs take place—not just the resources themselves that are significant. These variables, to say nothing of agricultural soils, rainfall patterns, and

distributions of raw materials, determine the critical element of a settlement pattern: the carrying capacity of the land.

Carrying capacity is the number and density of people that any tract of land can support. It is a flexible statistic that can be affected by factors other than those of the available resources in an area. People can alter the carrying capacity of their land by taking up agriculture or by cultivating a new crop that needs deeper plowing and thus exhausts the land faster. Conversely, the introduction of fertilizer can enable people to settle permanently in one village because their lands are kept fertile artificially. Ancient carrying capacities are difficult to establish, except with carefully controlled data. Recent research has concentrated on systems models and computer simulations of the variables that affect carrying capacity.

One approach is site-catchment analysis, which assumes that every human settlement has a catchment area around it. This is a zone of domestic and wild resources within easy walking distance of the settlement. The fundamental assumption is simple: The farther the resources in an area are from a site, the less likely they are to be exploited (Bailey, 1981). Two key concepts are important: site-exploitation territory and site-catchment analysis.

Site-exploitation territory is the potential area from which food resources may be obtained. Its boundaries are defined by “least-cost” principles, by the maximum radii of the distances that people are willing to cover on foot. Much depends on the nature of the resources and how they are exploited. For example, in two hours’ walking-time a person can cover about 6 miles (10 km)—a reasonable distance to travel for some purposes. But a much smaller radius of half a mile (1 km) is useful when analyzing farming economies where land is exploited intensively, for it is the most economical use of labor to cultivate land close to the village. The boundaries of such radii are based on assumptions about normal human behavior and on examination of the economic potential of resources lying within them. Thus, site-exploitation territory is little more than a statement of what was potentially available to the site inhabitants (see the Doing Archaeology box).

The economic catchment area of a site is quite different from the site-exploitation territory. It is the actual area from which the food

resources consumed by the inhabitants are obtained. Such areas vary in size and shape according to the resources exploited, the site function, and the lifeway of its inhabitants. Clearly, the accuracy with which the economic catchment area can be defined will depend on the precision with which one can identify food remains in the site itself.

Site-catchment analysis involves examining both the economic catchment area and the site-exploitation territory as a way of assessing the relationship between what was potentially available in the environment and what was actually exploited. Determining ancient site catchments may be very difficult, as the modern environment may be quite different from that in the past. Analysis using the geographic information system (GIS) offers great potential for the study of site catchments, for it allows the archaeologist to overlay such features as topography, hill slopes, soil distributions, and the like onto site catchments and site-distribution territories. When combined with indications of social and cultural patterns, these data may provide dramatic insight into the past.

Case Studies of Settlement Distribution

For years, the study of community distributions depended on large-scale archaeological surveys that combined aerial photographs with months of systematic foot survey on the ground. William Sanders and a large research team from Pennsylvania State University surveyed the entire Valley of Mexico, center of the Aztec civilization, in the 1970s. They compiled distribution maps of every known archaeological site and plotted them against comprehensive environmental data, with dramatic results. Sanders showed how the population of the basin ebbed and flowed over many centuries, with the rise and fall of the great city of Teotihuacán in the first millennium A.D. (Sanders et al., 1979).

The most dramatic changes came when the growing Aztec capital, Tenochtitlán, achieved overwhelming dominance (see [Figure 15.4](#) on page 292). Although Sanders's population estimates were only highly informed guesses, the data show a dramatic rise over several centuries. By the end of the fifteenth century A.D., the imperial capital housed at least 200,000 people, living in dense residential areas now buried under

the concrete jungle of modern Mexico City. The concentration of sites nearby was such that Sanders estimated that at least 400,000 city and country dwellers occupied a 230-square-mile (370 sq. km) zone of foothills, plains, and lake bed areas near the capital. He calculated that about 1 million people lived within the confines of the Basin of Mexico at the time.

Tenochtitlán stood at the center of an organized landscape, created by ambitious rulers who thought nothing of creating nearly 25,000 acres (10,000 ha) of highly productive swamp gardens in the southern part of the basin alone. The city was a magnet to outlying populations, and its very presence skewed the entire settlement pattern of the basin. So many people lived there that the Aztecs farmed every local environment in the region to ensure that there was enough food to go around. Over less than two centuries, the settlement pattern changed from a patchwork of small states and communities to a highly centralized agricultural landscape capable of meeting the basic food needs of a large population.

Few settlement patterns show such dramatic changes as those in the Basin of Mexico. Sanders was a pioneer in combining environmental and archaeological data in settlement archaeology, but his project was unsophisticated by the standards of some of today's projects, which use high technology to integrate field surveys with a wide variety of spatial data.

Doing Archaeology Studying the Maya Collapse at Copán, Honduras

The collapse of Classic Maya civilization in the southern lowlands of Mesoamerica during the ninth century A.D. is one of the great controversies of archaeology. For generations, scholars have argued vehemently over this sudden collapse. Was the decline caused by social unrest, warfare, or ecological collapse? Or did the Maya nobility place too many demands on their farmer subjects? The debate continues, marked by a lack of reliable scientific data from the field, except for a remarkable study of changing settlement patterns and population distributions at the city of Copán in Honduras (Andrews and Fash, 2005; Freter, 1994).

Copán was one of the greatest Maya cities, founded in a fertile valley before the fifth century A.D. On December 11, A.D. 426, a Maya lord named Kinich Yax K'uk Mo' ("Sun-Eyed Green Quetzal Macaw") founded a dynasty that ruled for four centuries. Copán soon became a major kingdom of the Maya world, with a spectacular urban core that covered 36 acres (14.6 ha). (See [Figure 9.13](#) on page 173 and [Chapter 8](#).) Between 550 and 700, the Copán state expanded dramatically, with most of the population concentrated in the urban core and immediately around it. By 800, between 20,000 and 25,000 people lived in the general Copán Valley area. Then, in 822, the royal dynasty ended and the kingdom collapsed.

What accounts for Copán's decline? Archaeologists David Webster, William Sanders, and many colleagues, working on a long-term investigation of the city, decided to look at the collapse by studying changing settlement patterns and shifting population densities around the abandoned city (Webster et al., 1999). They developed a large-scale settlement survey modeled after the famous Basin of Mexico survey of some years earlier to examine more than 52 square miles (135 sq. km) around the urban core. Using aerial photographs and systematic field surveys, the research team recorded more than 1,425 archaeological sites containing more than 4,500 structures. Team members mapped and surface-collected each location. There were 252 sites test-pitted to obtain artifact and dating samples so they could be placed within the general chronological framework for the valley.

As the data flowed into the laboratory, the researchers developed a classification of site types using size and other criteria, classifying them in a hierarchy from simple to complex as a way of developing a portrait of shifting landscape use over many centuries. At the same time, they obtained 2,300 dates, using volcanic glass fragments that could be dated using the obsidian hydration method (see [Chapter 7](#)). The survey yielded a bird's-eye view of dramatic population changes as human settlement expanded and contracted over the valley landscape.

The earlier sites found in the survey documented rapid population growth, especially in the city itself and nearby. There was only a small, scattered rural population. Between 700 and 800, the Copán Valley reached its greatest sociopolitical complexity, with a rapid population increase to between 20,000 and 25,000 people. These figures, calculated

from site size, suggest that the local population was doubling every 80–100 years, with about 80 percent of the people living within the urban core and immediate periphery. Rural settlement expanded outward along the valley floor but was still relatively scattered. Now people were farming foothill areas, as the population density of the urban core reached over 8,000 people per 0.3 square mile (0.5 sq. km), with the periphery housing about 500 people per 0.3 square mile (0.5 sq. km). Some 82 percent of the population lived in relatively humble dwellings, an indication of the pyramid-like nature of Copán society.

After A.D. 850, the survey showed dramatic shifts. The urban core and periphery zones lost about half their population, while the rural population increased by almost 20 percent. Small regional settlements replaced the scattered villages of earlier times, a response to cumulative deforestation, overexploitation of even marginal agricultural land, and uncontrolled soil erosion near the capital. By 1150, the Copán Valley population had fallen to between 2,000 and 5,000 people.

The Copán research does not explain why the city collapsed, but it does chronicle the dramatic impact of rapidly growing populations on ecologically fragile landscapes. The evidence hints that environmental degradation was a major factor in the Maya collapse. Maya writings tell us that Maya lords considered themselves the intermediaries between the living and supernatural worlds. However, when the inexorable forces of environmental decline took hold, their authority evaporated and a centuries-old spiritual relationship between farmers and an elaborate cosmic world vanished into near-oblivion.

Geographic Information Systems and Roman Wroxeter, England

Studies of settlement distributions have proven particularly useful in examining past sociocultural organization and change (see also [Chapter 16](#)). Viroconium Cornoviorum, the Roman town at present-day Wroxeter, near Shrewsbury in west-central England, was the fourth-largest urban center in Roman Britain. Wroxeter started as a legionary camp in A.D. 60, then became a town 30 years later, flourishing until the fifth or sixth century. Most Roman towns lie under modern cities such as London or York. Fortunately for archaeologists, much of Wroxeter is in open country. For more than a century, generations of excavators

investigated the major public buildings and commercial zone of the town. They used aerial photographs and surface collections of potsherds and other artifacts to plot the general outlines of the settlement and to develop a detailed chronology of its buildings.

But these approaches could not answer fundamental questions about the history of a once-strategic military gateway into neighboring and unconquered Wales. Many Roman forts and camps lie close to the town. What impact did these army encampments have on the rural population? What were the consequences of the Roman conquest on local Iron Age farmers?

To answer these questions, Vincent Gaffney and an international team of researchers combined the powerful technology of the GIS with aerial photographs and ground surveys. This meant the archaeologists could draw on a massive archive of aerial photographs of the surrounding countryside, taken under every kind of weather condition imaginable over more than half a century. They located over 40 farming enclosures and the remains of a once-extensive field system. The researchers “warped” digital images of the aerial photographs onto Britain’s national map grid, turning the images into GIS maps so accurate that a fieldworker could measure and interpret such features as the Roman street grid at Wroxeter itself with margins of error as small as 3 feet (1 m). (Figure 15.16).

Figure 15.16 (a) An aerial view of Roman Wroxeter, the fourth-largest Roman city in Britain. Originally a military fortress, Wroxeter (Viroconium) became a thriving city. (b) GIS research in the Wroxeter region: These data, derived from many sources, including generations of aerial photographs, provided the background data for the survey of Roman Wroxeter’s hinterland. The map shows the Roman city and outlying sites and the three transects walked by archaeologists on the ground. Wroxeter is unique among Roman towns in Britain in not being buried under a modern city. Thus, it is unusually important for settlement studies.

Source: Courtesy of Science Source. Reprinted by permission of Vincent Gaffney, Visual and Spatial Technology Center, University of Birmingham, England.

The Wroxeter project was pioneering in that the archaeologists working on the ground were able to manipulate all available

archaeological data on the screen before they even went into the field. The fieldworkers relied heavily on volunteers, who recorded the Roman town's topography by taking measurements every 33 feet (10 m). A magnetometer survey combined with ground-penetrating radar revealed hitherto unknown buildings on the edge of the town. For generations, experts on Roman Britain had called Wroxeter a carefully planned "garden city," with parks and open spaces. The GIS and remote sensing have revealed a less well-organized community with uncontrolled expansion at its margins as it drew people from the surrounding countryside. In this way, the archaeologists were able to study a dynamic, ever-changing settlement pattern. But here is a final word of caution: The archaeological data in GIS databases are selected by the researcher and are subject to subjective judgment. Subsequently, GIS interpretations are limited by the data input.

West Africa in the Era of the Atlantic Trade

The Atlantic slave trade, which peaked in the late eighteenth century, engulfed vast portions of West and Central Africa. Between the sixteenth and mid-nineteenth centuries, some 12 million to 15 million enslaved peoples were transported across the Atlantic to provide labor for the burgeoning plantations of the Americas. Although the horror of the slave trade has been widely written about in contemporary accounts and modern studies, evaluation of the consequences and impacts of the slave trade on African societies has been limited by the lack of written records for the majority of the regions where slaves were obtained. Most of the sources that do exist were written by European visitors to the coast who had no familiarity with the vast African hinterland. African oral traditions are also lacking for many areas, or they provide only limited information relevant to the period of the slave trade.

Although written records may be lacking, archaeological evidence of changes in settlement organization, location, and distribution, as well as artifact inventories dating to periods associated with the rise of the Atlantic trade, can be used to infer related social, cultural, and political changes (DeCorse, 2001). While many parts of Africa remain poorly known archaeologically, relevant information is accumulating. It

indicates that the era of the Atlantic trade was a time of tremendous transformation in West Africa. The changes that took place in African societies varied, as did their responses.

The appearance of fortified settlements or the relocation of towns from fertile valleys to rocky, inaccessible—but easily defended—hilltops in some regions provides clues to the need for defense against raids for slaves. Such is the case in many parts of Sierra Leone, Liberia, Ghana, Togo, and Cameroon, where settlements surrounded by ditches, palisades, and impenetrable thickets of thorn bushes protect many eighteenth- and nineteenth-century settlements. In the western Adamaoua mountain range of Cameroon, where over 100 settlements have been mapped, large villages with terraced fields are located beyond a line of fortified camps (Holl, 2001). The camps, surrounded by circular ditches and earthen embankments, were likely defense against slave raiding by neighboring ethnic groups, particularly the Fulani. In other areas, as in coastal Ghana, a pattern of smaller, dispersed settlements gives way to larger communities, which may have provided more security.

These changes in settlement patterns are indicative of changes in sociopolitical organization. A case in point is the Fulani, who were nomadic pastoralists living in small transitory settlements in the fifteenth century. By the eighteenth and nineteenth centuries, they were settled in towns with ruling nobility. The emerging Fulani states expanded into neighboring non-Islamic areas and thus caused dramatic expansion of Islam and Fulani cultural identity.

The Atlantic trade is not necessarily the sole explanation for all of the transformations that occurred in West Africa over the past five centuries, but the fact that the timing of some of the archaeological patterns observed correspond to historically known trade patterns and socioeconomic developments suggests an important link.

The Archaeology of Landscape

Landscapes are very different from settlement patterns. Humans create landscapes. They are like a piece of marble, which changes in response to the sculptor's chisel. Perceptions of the landscape change constantly, whether in fair or foul weather. Places on the landscape are laden with

meaning. Caves can be conduits to the underworld, places where shamans passed in trace into the supernatural realm. Cloud-shrouded mountain peaks can be abodes of gods and mythic heroes. The Nile was sacred to the Egyptians; the city of Teotihuacán was built on a long-term master plan oriented toward the cardinal directions, each of which had their own gods, even their own colors. Even today, some societies hold certain trees sacred, attribute supernatural qualities to fire and water, and assign benign and evil qualities to different winds. These are intangible qualities, which change with the generations and vanish utterly when a site is abandoned or a society goes into eclipse. Even then, the landscape of memory continues to change as new people and fresh settlements spread across the landscape, or the plow replaces the digging stick, the automobile replaces the horse-and-cart. The Céide Fields in northwestern Ireland described at the beginning of this chapter are a vivid example of a changing landscape. The ancient Stone Age landscape is not all, for the surrounding countryside bears ample signs of much later occupation, including abandoned farms from the era of the Irish potato famine of 1845 to 1848, which killed tens of thousands of people. The archaeologist Seamus Caulfield was born in a small village in the heart of this landscape, and has vivid memories of the changes in its own lifetime and in that of his parents and grandparents—his own landscape of memory.

We've come to think about the "archaeology of landscape" as opposed to settlement distributions. Some mention of this new avenue of archaeological inquiry is important at this juncture because it ties in with two major topics in [Chapters 16](#) and [17](#): human interactions and the archaeology of the intangible.

The word landscape defies easy definition, but everyone agrees that landscapes are created by humans. In archaeological terms, the landscape around Maya Copán or Stone Age Avebury in southern England has changed ever since humans first settled in both areas. Our challenge is to reconstruct the landscape as its various users saw it, the "landscape of memory." As archaeologist Stephanie Whittlesey remarked: "Landscapes are the spatial and material manifestation of the relations between humans and their environment" (1998: 27). (See also Crumley and Marquardt, 1987.)

Archaeologists study landscapes in many ways: with ecologically

based systems approaches, with technology-laden methods that involve GIS and satellite data, and, at the other extreme, in almost literary fashion, describing such phenomena as eighteenth-century gardens or French markets (Crumley, 1994). (See [Figure 15.16](#).) A new generation of settlement research is turning to landscape geography as a means of studying actual ancient landscapes, where symbolic relationships to the environment as well as ecology play important roles (see the People of the Past Box on pages 354–356 in [Chapter 17](#)). The term landscape signature describes what archaeologists study in this context: “the material imprints left on the earth’s surface by particular constellations of human groups” (Crumley and Marquardt, 1987: 4).

Many archaeologists engaged in landscape research think in terms of three dimensions of organizing landscape (Zedeño et al., 1997): (a) physical characteristics and properties, (b) historical transformations over time, and (c) people’s physical and symbolic relationships with their environments.

Landscape analysis is a form of historical ecology, where changing landscapes over long time periods serve as cultural records. Landscapes are symbols of cultural stability that preserve enduring meanings over time. As such, they are as much a cultural record as an individual site and an artifact, and, when considered as a way in which people organize their relationship with the social world, a potentially vital source of information on ideology and cultural intangibles (see [Chapter 17](#)). Much of this research is informed by ethnographic and historical records. The team of archaeologists who carried out a large-scale cultural resource management (CRM) survey of the Lower Verde Valley in Arizona were charged with the task of studying changing land-use patterns over long periods (Whittlesey et al., 1998). To do this, they recorded contemporary and historical landscapes of both Europeans and Native Americans and then worked from there into the remoter past with a theoretical structure based on landscape theory.

Figure 15.17 Archaeology of landscape. The reconstruction of William Paca’s eighteenth-century garden in Annapolis, Maryland, which reflected landscape perspectives of his day. The outlines of the yard were established by archaeological investigations; the terraces and plantings are conjectural.

Source: Image by Brian Fagan.

Remote sensing has a powerful role to play in research into cultural landscapes. As we saw in [Chapter 8](#), light detection and ranging (LiDAR) is changing how archaeologists document archaeological landscapes at a regional scale (Figure 15.19). Its use is having a massive effect on landscape studies, since LiDAR can map large areas in relatively little time, including otherwise inaccessible, or densely overgrown, areas. Furthermore, the information collected is “objective,” since point-density levels are applied equivalently over the entire block of collected data (though naturally this does not mean that there are no biases in data collection or processing methods, but the biases are not site specific) (Rosenwig et al., 2015).

Figure 15.18 A LiDAR image of the great house of William Paca called Wye Hall and the surrounding platforms, which were the setting for the 1790s garden designed by Luke O’Dio for Paca and built by his slaves. The image was the first version and shows the tops of trees as well as the house, terraces, and excavated trenches.

Source: Courtesy of James M. Harmon, National Park Service; Mark P. Leone, University of Maryland; Stephen D. Prince, University of Maryland; and Marcia Snyder, University of Maryland.

A fascinating example of landscape survey using LiDAR has been taking place at the rich archaeological area of Izapa in Chiapas, Mexico, under the direction of Robert Rosenwig of the University at Albany. The Izapa Regional Settlement Project, launched in 2011, has been using a combination of LiDAR and foot-based survey over a survey zone of some 400 km² (154 sq. miles).

This has allowed the researchers to explore the complex issues of changing settlement patterns and population trends at Izapa and nearby areas. At present the evidence indicates that there was a significant population increase during the Terminal Formative (A.D. 100–300) and initial Early Classic (A.D. 300–400) periods, followed by a virtual abandonment of both the piedmont and lowhills survey zones from A.D. 400 to A.D. 700, which in turn was followed by a population increase from A.D. 700 to A.D. 1000 (Rosenwig and Mendelsohn, 2016). Together, the results of LiDAR survey and systematic pedestrian survey are providing the first glimpse of changing population dynamics and political organization around Izapa during the first millennium A.D.

Such research is still relatively new in archaeology, but it is thriving as archaeologists become more aware of the close relationships between people and their land, contrived or not. Robert McPherson eloquently described this relationship among the Navajo:

The earth is not just a series of dramatically poised topographic features that incite the wonder of man or beckon for exploitation, but is rather a living, breathing entity in an inanimate universe. The land with its water, plants, and animals is a spiritual creation put into motion by the gods in their wisdom. These elements are here to help, teach, and protect through an integrated system of beliefs that spell out man's relationship to man, nature, and the supernatural. To ignore these teachings is to ignore the purpose of life, the meaning of existence.

(1992: 11)

When archaeologists study ancient settlements and their now long-vanished landscapes, they would do well to remember those words. We will return to the issue of landscapes in [Chapter 18](#).

Summary

1. Settlement archaeology, the study of changing human settlement patterns, is part of the analysis of adaptive interactions between people and their natural and cultural environments.
2. Settlement patterns are the layout and distribution of human settlements on the landscape. They are determined by many factors, among them the environment, sociocultural practices, and technology, as well as practical considerations, population growth, and social organization.
3. Bruce Trigger defines three levels of settlement: buildings and activity areas, the arrangement of structures within individual communities, and the distribution of communities across the landscape. The patterns involved in these levels result from factors that differ in quality and degree from the other levels.
4. Single structures can be studied from the perspective of form and material or from a functional viewpoint. Social and political institutions also affect the design of individual houses.

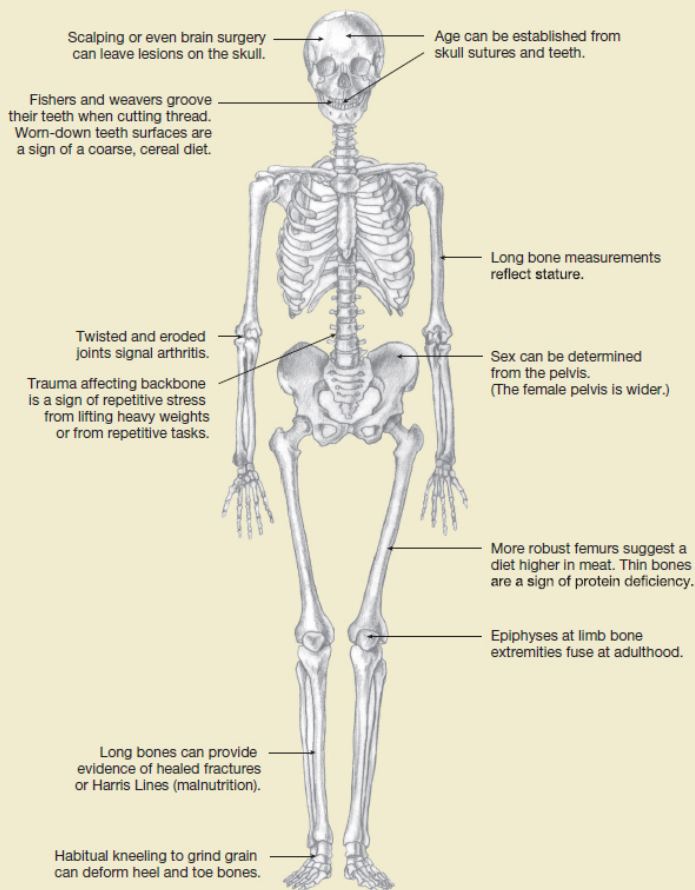
5. A community is a maximal group of people that normally resides in face-to-face associations. The layout of communities is much affected by political and social considerations. The archaeologist looks for clusters of settlement attributes that may indicate a grouping of social units.
6. Site-catchment analysis is a method used to inventory resources within range of prehistoric sites. It is a study of the relationships between technology and available natural resources.
7. Population estimates of individual communities are very difficult to obtain, even from comprehensive archaeological data; there simply are too many variables that affect the archaeological record.
8. Population estimates for prehistoric sites have been made using subjective guesswork, mathematical formulas, and sophisticated estimates of the carrying capacity of the land. Such estimates are rarely precise.
9. Landscape is a cultural construct, and the archaeology of landscape is an attempt, using scientific data, to look at the intangibles that defined the relationship between people and their ever-changing landscapes.

Further Reading

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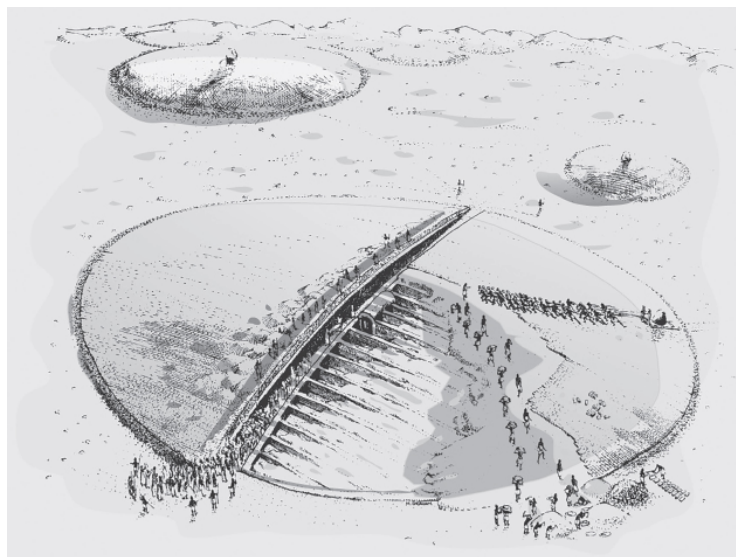












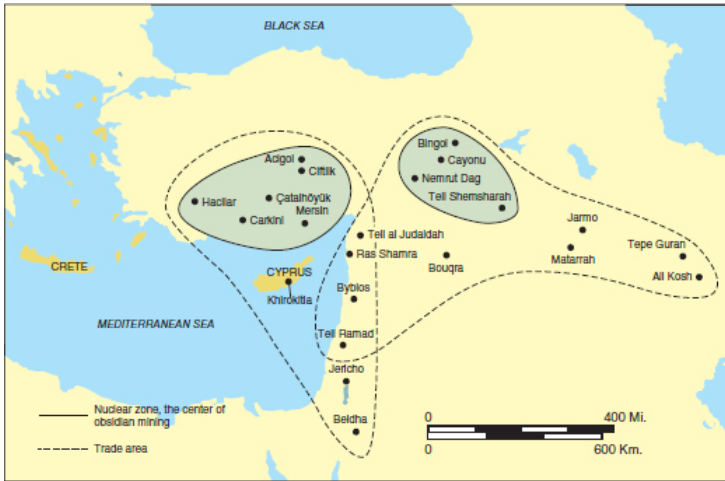
IA: Copper axes	IA	7 burials in central mounds	
IB: Copper earspools, bear teeth, stone discs	IB	43 mound and nonmound burials	A
II: Shell beads, copper gorgets, galena	II	67 mound and nonmound burials	
III: Effigy vessels, animal bone, shell gorgets	III	Nonmound burials III: 221	B
IV: Discoidals, bone awls, projectile points	IV	IV: 50	
V & VIII: Bowls	V	Nonmound burials V: 55	
VI, VII, & IX: Water bottles	VI	VI: 45	
	VII	VII: 55	
	VIII	VIII: 70	
	IX	IX: 46	
	X	X: 70	
No grave goods		1256 burials	C

(a)



(b)





16

Interactions

People of the Past

CHAPTER OUTLINE

An Individual: Ötzi the Ice Man

Bioarchaeology: What Human Bones Tell Us

Genetics and DNA

Groups: Ancient Social Organization

Gender: (Beyond) Men and Women

Engendered Research

Ethnicity and Inequality

Exchange and Trade

A youthful boxing match painted on the wall of a house at Akrotiri, Santorini Island, Greece, circa 1700 B.C.

Source: Courtesy of robertharding/Alamy Stock Photo.

Egyptian pharaoh, Maya lord, Pueblo farmer, Ice Age forager—all are equal in the face of death and modern archaeological and medical science. Human skeletons, frozen corpses, and mummies are the medical records of the past, one of the few ways we can study actual individuals from ancient societies. Some famous individuals from the past are known to us by name, well-known rulers like the Egyptian kings Seti I and Rameses II, and the Maya lord Pacal, buried under Palenque's Temple of the Inscriptions at Palenque, Mexico. There are others, like the Moche Lords of Sipán, who dazzle us with their ornaments and possessions, but we don't know their names. Most individuals from the past survive as nameless corpses or skeletons, members of long-forgotten communities far from royal courts and magnificent temples. For all their anonymity, their bodies yield priceless information about their lives.

This chapter turns from settlements and landscapes to the actual people of the past and their dealings—as men and women, as small groups within diverse societies, as communities trading with one another.

An Individual: Ötzi the Ice Man

Only rarely do archaeologists have the chance to study a well-preserved individual from the remote past. When they do, the full array of modern medical sciences comes into play.

In September 1991, German mountaineers Helmut and Erika Simon made their way around a narrow gully at 10,530 feet (3,210 m) near the Similaun glacier, in the Ötztal Alps of South Tyrol (Spindler, 1994). Erika suddenly spotted a brown object projecting from the ice and glacial meltwater in the bottom of the gully. At first she thought it was merely a doll, but she soon identified the skull, back, and shoulders of a man with his face lying in water. She had stumbled across a casualty of

a 5,000-year-old mountain incident.

The first police on the scene assumed that the man was a climbing victim. A unique archaeological find became corpse number 91/619 on the local coroner's dissection table. Within days, the authorities realized that the body was very old, and they called in archaeologist Konrad Spindler of the University of Innsbruck, Austria. Local archaeologists organized a dig at the site, which was already under 2 feet (0.6 m) of snow. They used a steam blower and a hair dryer to recover parts of a grass cloak, leaves, tufts of grass, and wood fragments. By the end of the excavation, they had established that the man, now nicknamed "Ötzi the Ice Man," had deposited his ax, bow, and backpack on a sheltered ledge. He had lain down on his left side, his head on a boulder, perhaps taking shelter from rapidly deteriorating weather in the small gully. His relaxed limbs suggest that the exhausted man had gone to sleep and frozen to death a few hours later. For 5,000 years, Ötzi's body lay in the gully, which protected his corpse as a glacier flowed overhead.

Once safely preserved in cold storage, an international team of scientists deployed the latest archaeological and medical science to conserve and study the 47-year-old man. (The Ice Man actually died a few feet into Italy, so after considerable legal wrangling the body is now in Italian hands.) Within a few weeks, five accelerator mass spectrometry (AMS) radiocarbon dates dated Ötzi's body to between 3350 and 3150 B.C. Biological anthropologists estimated his height at about 5 feet 2 inches (1.6 m) and took DNA samples.

Where had he lived? Using his bones, intestines, and teeth, a research team was able to reconstruct his life from isotopes and trace elements (Müller et al., 2003). Dental enamel is fixed when a tooth is formed, so the teeth the scientists examined contained the signature of trace elements in food eaten when the Ice Man was three to five years old. However, bone is remineralized every 10–20 years, which provided information on Ötzi's whereabouts when adult. Tiny specks of mica in his intestine helped pin down where he last lived before his death. Fortunately for us, he lived in a geologically and topographically very complex area, where ratios of the stable isotopes in rainfall vary with altitude and geology. Putting together the various signatures, they showed that he was born in one of several river valleys in the southern

Tyrol, the strongest candidate being the Eisack Valley, south of the mountains. However, bone isotopes show that he lived at higher altitudes further north as an adult. The mica in his intestine probably came from grindstones used to prepare the wheat and barley he ate shortly before he died. By dating the tiny grains with argon dating, the researchers pinned the mica down to the small, lower Vinschgau area, west of the Eisack Valley. Thus, Ötzi was born in the lowlands, spent time in the mountains of lower Vinschgau, and may never have strayed more than 37 miles (60 km) from his birthplace.

The isotopic analysis of his teeth and bones further revealed that his life was far from “easy.” As a young person, Ötzi endured prolonged malnutrition in his ninth, fifteenth, and sixteenth years. His hands and his one remaining fingernail were scarred from constant manual labor. The analysis of the fingernail showed he had suffered from episodes of serious illness (bacteria indicate infection by Lyme disease) in the months before his death. When he died, he was also suffering from parasites, while his little toe showed traces of chronic frostbite. Eight of his ribs had been fractured, though all were healed or in the process of healing. Isotopic analysis of his hair suggested he had eaten a vegetarian diet for the last few months of his life, living off bread and cereal porridge, though subsequent examination of his stomach contents showed that his last meal was of rich and heavy meal of ibex mixed with wheat bran and plums. Despite his disease and broken ribs, a body scan revealed that his brain, heart, digestive organs, and muscle tissues were all in excellent condition. However, his lungs were blackened, as much as those of a modern-day smoker, probably the result of inhaling smoke from open fires, perhaps while living in small dwellings with open hearths. He also had groups of tattoos—mostly parallel vertical lines—on his lower back, left calf, and right ankle, which may feasibly have had a therapeutic purpose, perhaps aimed to relieve the arthritis he endured in his neck, lower back and right hip.

On his last day alive, Ötzi wore a leather belt that held up a loin cloth. Suspenders led from the belt to a pair of fur leggings. He wore an outer coat of alternating stripes of black and brown animal skin and an outer cape of twisted grass, just like those worn in the Alps a century ago. Ötzi’s bearskin cap fastened below his chin with a snap. On his feet he wore bearskin and deerskin shoes filled with grass held in place by a

string “sock” (see [Figure 16.1](#); see also [Figure 4.8](#) on page 73). Ötzi was a self-sufficient man on the move. He carried a leather backpack on a wooden frame, a flint dagger, a copper-bladed ax with a wooden handle, and a yew longbow and skin quiver filled with 14 arrows. His equipment included dry fungus and iron pyrite—for lighting fires—and spare arrowheads.

Today, Ötzi lives in a special freezer that replicates glacial conditions (www.iceman.it/en/). Scientists are still puzzling over the reason why he was so high in the mountains. A few wheat seeds lodged in his fur garments tell us he had recently been in a farming village. Some wild seeds came from a valley south of the Alps, as if he had climbed from the Italian side.

In one of archaeology’s longest-running detective stories, there is a great deal of discussion over exactly how and why he died. Originally, scientists thought that he had died a peaceful death, perhaps caught out while taking shelter in bad weather. Then they discovered an arrowhead was buried deep in his left shoulder, and there was a dagger wound on one of his hands, as if he had parried a close-quarters attack (Gostner and Vigl, 2002). DNA analyses showed that he fought with at least four people. The arrow wound proved fatal, for it caused him to bleed to death. The injured Ice Man may have fled into the mountains, then succumbed to his wounds.

Even more recent research has since questioned this scenario. Detailed analysis of pollen found in his gut suggested that he probably died in April—yet pollen analysis from the ice surrounding the Ice Man pointed to its formation in late summer and early autumn (moreover the pass in which he was found would have been covered in snow in the spring, rendering it impassable). How then can we account for the apparent mismatch between the time of his death (April) and the time of his burial (August/September)? One conclusion is that, after his death in April, the Ice Man’s corpse was lovingly conserved in his home village and then ceremoniously buried on the mountain in the autumn (Vanzetti et al., 2010).

[Figure 16.1](#) The Ice Man.

Source: Courtesy of Marco Albonico/Superstock.

But really? In yet another forensic contribution to the tale, Groenman-van Waateringe (2011), has performed experiments to test the idea that the Ice Man might have been taking medicine in the form of bark. This could explain the spring-time pollen in his autumn-time death. His work thus calls to question the rather convoluted interpretation of preservation and a formal mountain burial. Perhaps Europe's oldest identifiable individual was a rough ne'er-do-well who died alone, following a fight, after all.

Whatever the case, Ötzi the Ice Man is the earliest European to survive as an identifiable individual—with a further 15 radiocarbon dates from the body and associated items, all falling between 2265 and 2940 BC and averaging at 3300 BC. He is therefore one of the few people of the distant past to come down to us so well preserved that we know almost more about him than he knew himself—his injuries, his diseases, his parasites. One of archaeology's most compelling finds, his well-preserved body, and indeed the 70 objects found with him, provide an immediate and important window onto the distant past.

Bioarchaeology: What Human Bones Tell Us

Archaeology is a science that relies on the expertise of scientists from many disciplines. **Bioarchaeology**, the study of human remains found in archaeological sites, is one of them. Bioarchaeology is not a stand-alone science, but one of many specialized approaches—like, for example, zooarchaeology—to the primary objective of archaeology: to understand the people of the past and their behavior. In recent years, new advances in genetics and medical science generally have brought powerful new tools to bear on human remains and a whole new dimension to our study of ancient humanity (Buzon et al., 2005).

You never forget the first time that you unearth human bones. For one of us (Brian), it was a burial of a 45-year-old man found in a 1,000-year-old farming village in Central Africa. As the soft earth fell away from the skull, he felt as if he had come face to face with a once-living person. It was a strange experience to clear the bones and expose his skeleton crouched tightly in a small grave, the only decoration a string of freshwater shell beads around his neck. But there is far more to human skeletons than mere burial rites. The bones of the dead yield

priceless information on ancient people.

Sex and Age

Human remains are a mine of information not only about the deceased but also about the societies in which they lived. Brian Fagan excavated his Zambian skeleton at a time when studies of ancient humans were still in their infancy. Unfortunately, the bones were in poor shape, but Brian and his team were able to establish the sex and age of the skeleton from the fused sutures on the skull, the state of the teeth, and the ends of the limb bones, which were completely fused to the ends, the epiphyses. They also established that the man was 5 feet, 8 inches (1.76 m) tall by measuring the upper leg bones and using a formula to estimate his living height. (All of these estimates are at best close approximations but are usually relatively accurate, given our profound knowledge of the human skeleton.) Today, we can do far more, for bones provide telltale information on the cause of death, nutrition, diseases and chronic medical conditions, including parasites, and diet and nutrition (see [Figure 16.2](#)). While individual skeletons can yield valuable information, a sample population from a cemetery is the biological anthropologist's dream, for then one can study overall health, life expectancy, infant mortality, and even differences in diet within a contemporary population.

The 206 bones of the adult skeleton form the internal structure of our body, protect vital organs within it, and operate with our muscular system to allow us to move. We manufacture blood cells in our bone marrow, store nutrients, and also store the elements that maintain and repair vital tissues. Every archaeologist needs a working knowledge of the human skeleton, for sometimes individual bones or limb bone fragments can turn up in an excavation far from any grave. As with animal bones, you identify them by comparing the fragments with human skeletons in the laboratory.

These kinds of basic information are of considerable interest, especially if one looks at populations through time. Nikola Koepke and Joerg Baten (2005) studied 2,938 female and 6,539 male skeletons from Europe dating to the past 2,000 years. They found that females tended to vary more than males, but stature varied with population density

and social inequality, also climate and gender inequality. On the other side of the world, Maya commoners were shorter than nobles, almost certainly a result of dietary differences.

Figure 16.2 Some categories of information that can be gleaned from human remains.

Violence

Paleopathology, the study of medical conditions and injuries of people of the past, does not often reveal specific causes of death, except in the cases of fatal wounds inflicted by weapons of all kinds. A stone ax may fracture someone's skull, leaving characteristic and traumatic wounds. Cut marks on bones from swords or daggers are not infrequent, although few rival the savagery revealed by the bones of the dead from the Battle of Towton in northern England, fought in A.D. 1461 (see the Site box).

Violence abounds in archaeological sites, right back to Stone Age times. Some wounds result from hunting injuries, commonplace, for example, among Neanderthal males, whose simple spears required them to attack even large animals at close quarters. Few Neanderthal hunters lived beyond 35 years of age. Cemeteries of Egyptian hunter-gatherers of 12,000 years ago include numerous arrow injuries, perhaps resulting from conflict over precious food resources in an ever-more crowded world.

The Chumash Indians of the Santa Barbara Channel area of southern California lived in an area where natural upwelling close offshore in the Pacific supported rich fisheries. They were consummate fishers and seafarers, who also relied heavily on plant foods such as acorns. Chumash populations grew steadily in an environment that was seemingly bountiful but subject to extreme disruptions caused by severe droughts and major El Niño events. By A.D. 1100, the Chumash lived in large communities, some of them villages with more than 1,000 inhabitants. Biological anthropologists Phillip Walker and Patricia Lambert studied skeletons from Chumash cemeteries and found a startling rise in traumatic injuries such as fatal arrow wounds and blows to the head (Lambert, 1993). At the same time, she found a sharp increase in evidence for dietary stress and malnutrition.

Cannibalism

Cannibalism, the consumption of human flesh, horrifies us, but has been part of human societies since Neanderthal times, perhaps even earlier. Over 75,000 years ago, a group of Neanderthals at Krapina in Croatia butchered at least 13 people, splitting open their bones to extract the marrow, just as they did for the animals found with them. Reports of human sacrifice in the past are commonplace, notably among the Maya and the Aztec, who acquired an unsavory reputation for the consumption of human flesh from Hernán Cortes and his conquistadors. Perhaps as many as 20,000 human victims perished on Aztec altars each year, but the figure is little more than a guess. Most authorities now agree that the Aztecs certainly displayed the skulls of their victims on special racks, but probably ate little or no human flesh except, perhaps, in a strictly ritual context.

S i T E > A Mass Grave From the Battle of Towton, England, **A.D. 1461 <**

England's War of the Roses pitted two major factions seeking to control the throne against each other in a bloody civil conflict that began in A.D. 1455. On a bitterly cold March 9, 1461, two large medieval armies of Yorkists and Lancastrians fought a ruthless battle in a snowstorm near the small village of Towton in northern England. The engagement lasted ten hours and is said to have been the bloodiest conflict ever fought on English soil, a hand-to-hand battle with no quarter given on either side. Eventually the Yorkists prevailed and the Lancastrians fled. Hundreds of exhausted soldiers were cut down in their tracks. As many as 28,000 soldiers perished; local rivers ran red with blood; corpses scattered a swathe of countryside 6 miles (9.65 km) long.

The battle passed into history, but plowshares brought up human bones for centuries. In 1996, the foundations for a new garage building at Towton Hall yielded skeletal remains and a portion of a mass grave (Hardy et al., 2007). Subsequently, a rescue excavation revealed a rectangular pit and yielded the remains of at least 38 individuals who had fought in the battle. These remains provide a compelling portrait of a brutal hand-to-hand battle and its aftermath.

All of the individuals were males between 16 and 50 years old, many

of whom had perished from traumatic injuries to the head. For the most part, they were healthy, active men, whose upper limbs displayed signs of alteration that resulted from strenuous activity from an early age. Such activities may have involved agricultural implements such as hoes, as well as axes and bows. A few displayed injuries to their left elbows that were identical to a condition known as “Little League Elbow,” first identified among youthful baseball players in Southern California. The Towton soldiers certainly didn’t play baseball, but they engaged in stressful arm movements caused by drawing heavy long bows. At least one had also ridden horses habitually, with resulting ossification of the buttock muscles on each femur head. Some skeletons displayed healed sword cuts, as if they had fought in previous battles.

Medieval battles conjure up images of romantic chivalry, but the Towton skeletons reflect a much harsher reality. Most of the skeletons from the grave had perished from savage blows or cuts to the head. Painstaking reconstructions of individual skulls revealed terrible injuries (see [Figure 16.3](#)). One man died from a large blade wound that bisected his face. One skull displayed at least eight blade wounds resulting from close combat, death coming from a lethal blow to the back of the head. Other crania displayed traumatic injuries made by crossbow bolts, arrowheads, and war hammers. Most wounds to the limbs were confined to the forearms, received when parrying blows from assailants. The right forearm was especially vulnerable, since this was the side where weapons were usually carried. Apart from fatal wounds, many of the skeletons displayed penetrating and superficial injuries caused by daggers, swords, and poleaxes, as well as arrows. One individual had nine different wounds on the neck, arms, and shoulders.

The Towton mass burial offers a portrait of frenzied killing that pitted soldier against soldier in an orgy of savage blows to the head, which continued even after the victims were incapacitated and unable to defend themselves. Very often, an attacker would try to knock his opponent off his feet, then kill him with blows to the head. Other, still-unexplored grave sites lie around the battlefield. This particular one was about a mile (1.6 km) from the main engagement, and perhaps was used to bury men fleeing at the end of the engagement, who were massacred as they fled. Whatever the role of the soldiers buried in this mass grave,

their skeletons provide a frightening portrait of the fear, vengeance, hatred, and bloodlust of medieval warfare.

Figure 16.3 The brutality of medieval warfare: A Towton soldier's skull with a fatal sword gash.

Source: Courtesy of Timewatch Images/Alamy Stock Photo.

Even the very thought of cannibalism raises violent passions, so it's very difficult to study it dispassionately. About the only way of doing so is to examine fragmentary human remains found in middens, such as have been excavated in the American Southwest. Here, the evidence for butchery is beyond controversy. Biological anthropologist Tim White, an authority on early hominins, applied the same methods to a bone deposit from Mancos Pueblo. He found that the human remains had been split, cut up, with the marrow extracted exactly as it had been from animal bones in the same garbage heap (White, 1992). Despite White's meticulous analysis, we do not know if actual consumption of human flesh took place. If it did, was it for symbolic, ritual purposes, or was it an attempt to supplement a diet of maize beans and game meat during a period of persistent hunger and drought? Cannibalism will always remain an enigma of the past, for the motives for consuming human flesh are always complex, and often profoundly secret.

Malnutrition, Stress, and Work-Related Injuries

The Ice Man suffered through several periods of malnutrition during his lifetime, identified both on his body and on Chumash skeletons as telltale **Harris Lines** found at the end of limb bones. The Chumash dead displayed other medical conditions too, lines them series of irregular lines on their tooth enamel, a sign of childhood malnutrition. Some skeletons also displayed the characteristic pitting and thickening of the eye sockets, a condition known as *cribra orbitalia*, resulting from anemia and parasitic infections.

Quite apart from medical pathologies, there are occupational injuries too, many of them resulting from repetitive tasks. Medieval fishers in Europe display spine deformations that result from years of hefting heavy nets. Many of the 87 adults from the early farming village at Abu Hureyra, Syria, displayed enlarged neck vertebrae resulting from

carrying heavy loads on their heads, as many subsistence farmers do to this day. Many of the young and adult Abu Hureyra women had collapsed vertebrae and arthritic big toes resulting from years of grinding grain on their knees. The repetitive back-and-forth movement played havoc with their spines.

The human skeleton is a major archive of information about our forebears. Sometimes it might be a completely random sample of a group, such as the crew of the Tudor warship *Mary Rose*, which sank in 1545. Very occasionally, a well-known individual might even be found, as was the case when a team of archaeologists made the sensational discovery of King Richard III in a car park in the English city of Leicester (see the Site box).

[S i T E > Richard III: Revealing the Life and Death of a Lost King <](#)

In September 2012, archaeologists announced the potential discovery of the remains of King Richard III beneath a car park in the city of Leicester, central England. Richard was king for only two years in 1483–1485, before being killed at the Battle of Bosworth outside Leicester. He might have passed into obscurity were it not for the fact that a century later Shakespeare wrote a play about him, casting him as the ultimate power-hungry villain, whose misshapen spine was as crooked as his morals.

The discovery was part of the Grey Friars Project, a research dig led by the University of Leicester that was investigating the location of a long-lost Dominican friary traditionally associated with the last resting place of Richard III. The dig, launched on August 24, 2012, was a masterpiece of archaeological detective work in which the archaeologists rapidly traced the friary complex piece by piece to pin down first the cloister, then the chapter house, church and choir. On September 5, 2012, the team found a grave beneath the choir. Located under a modern-day car-park, the grave coincidentally lay almost directly beneath a painted R daubed onto the tarmac roughly a decade earlier to denote the word “reserved.” At this point, the archaeologists agreed that the chances the body would actually be Richard’s remained unlikely.

However, given its special location beneath the choir, there was a chance. They knew that any surviving DNA must be kept uncontaminated in order to help confirm the body's identity. On site osteoarchaeologist, Jo Appleby, therefore, wore a full anti-contamination suit before examining the in situ remains. With painstaking precision, she worked up the body, known as "Skeleton 1." As she came to the spine she discovered a dramatic S-shaped bend, which fitted the Tudor caricature of "Richard Crookback," while its skull had major injuries that might suggest death on a battlefield. Armed with these strands of evidence, in mid-September 2012, the team met the press to announce the discovery of a "prime candidate" for England's last medieval king.

It was a daring claim, and the archaeologists faced considerable skepticism from certain circles. What were the chances, the critics scoffed, of finding a specific king, whose body—so tradition claimed—had in any case been thrown into the River Soar after the Dissolution of the Monasteries?

Of course we now know, with almost 100 percent scientific certainty, that they had found Richard III. But confirming its identity was an enormous undertaking that drew on an array of cutting-edge archaeological techniques. One vital avenue of investigation was the DNA analysis. Selected teeth and bones were examined in a clean-room lab of the University's Space Research Centre, chosen to ensure no DNA contamination from any organic sources. Though Richard III left no direct descendants with which to compare his DNA, medieval historian John Ashdown-Hill had traced an unbroken female line from one of Richard's elder sister to a modern family: the Ibsens.

Leicester University geneticist, Turi King, got to work analyzing the mitochondrial DNA (passed down on the X chromosome) from Michael Ibsen, a London-based cabinet maker. It provided a clear match with the bones of Skeleton 1. The team then checked every link in the genealogical chain and in the process they identified another female line relative, Wendy Duldig, whose DNA helped to triangulate the results, so confirming the match. Bayesian statistical analysis suggests that the possibility of Skeleton 1 being that of Richard III is somewhere between 99.9994 and 99.99999 percent. The team could now confirm that the body was, beyond all reasonable doubt, that of Richard III.

Turi King's sequencing of Richard III's genome revealed some interesting information about his appearance, including a 96 percent probability that he had blue eyes, and a 77 percent likelihood that he had fair hair, though perhaps he was blond only in childhood. These details were of significance to art historians who had long wondered about the reliability of known portraits of the maligned king.

Other techniques were used to piece together more about the king's life—and his death. The first step was to perform a computerized tomography (CT) scan of the skeleton at the Leicester Royal Infirmary. The cause of death was shown to be brutal: his bones bore the marks of numerous battle wounds, mostly to the skull, and using bladed weapons. Ten bones were then selected for further analysis at the lab of Sarah Hainsworth, Professor of Material and Forensic Engineering at Leicester. Hainsworth subjected the bones to detailed microscopic and micro-CT analysis, techniques she often uses when assisting police investigations. This is a lengthy process in which samples are rotated to less than a hundredth of a millimeter after each scan. Recoding the long bones took up to eight hours each, while the skull took an entire day. Her work revealed that a number of the wounds to the skull were probably inflicted by the same weapon—likely a rondel dagger with a square sectioned blade, according to Robert Woosnam-Savage, Curator of European Edged Weapons at the Royal Armouries. These wounds included shallow cuts on the cheek and jaw, plus a blow to the top of the head—the latter having been made with such force that the bone was pushed inwards—perhaps as a *coup de grace* to finish off the fallen victim. There was also massive trauma to the back of his head, this time made by a large bladed weapon, probably a blade mounted on a long halt. However, the fatal wound was probably a smaller-sized injury on the lower left of his head: a hole surrounded with a radiating fracture that lined up with another cut on the inner surface of the skull on the opposite side—suggesting a stabbing blow that had cut through the bone and right into the brain. This was a violent death involving sustained attack.

Yet the archaeological work went further still, revealing information about his life. As with Ötzi the Ice Man (this chapter and [Chapter 5](#)), analysis of the oxygen and strontium isotopes preserved in his tooth enamel showed where he spent his childhood, which indeed tallied with

historical records. It also showed relatively high levels of lead, a material commonly once used in water pipes and found in medicines and pewter drinking vessels. The research also revealed that his diet in the last few years of life was rich in protein and wine. Clearly a regime befitting a king! Despite the high life, soil samples taken from around the area of his pelvis indicated a body infested with roundworms, a condition typically spread by ingesting infected fecal matter (perhaps from the unwashed hands of one of his cooks).

After the extensive investigations of the body were complete, Skeleton 1—Richard III—was reinterred in Leicester Cathedral amid pomp and ceremony. This project remains one of the UK's most-lauded recent discoveries. It is extremely rare to find a lost named individual in the archaeological record. As we have seen, many resources were put into the investigation, and a wide range of cutting-edge archaeological techniques were used, including genetic examinations, forensic archaeology, and strontium analysis. To discover more, and to explore the new Richard III Visitor Centre in Leicester, go to: <https://kriii.com>

Figure 16.4 A sympathetic facial reconstruction of how the maligned Richard III might have looked based on the new archaeological research.

Source: Courtesy of Photimageon/Alamy Stock Photo.

Strontium and People's Lives

Iceland is a geologically recent island that emerged from the waters of the North Atlantic only some 25 million years ago. Iceland's volcanic landscape has a characteristic, very low isotopic signature, quite distinct from those from other parts of the world. Strontium enters the food chain from eroded rocks and provides geological signatures, which are preserved in tooth enamel of both animals and humans. If the signatures are known, then it is possible to identify the place of birth of the tooth's owner, which may or may not be the same location as where he or she died. As we have seen, such research wrote a life story of the Ice Man from the Alps. We now also know that the Amesbury Archer from southern Britain spent his early years in Central Europe, a long way from his place of death.

Strontium has the potential to write people's life stories, but there is

a long way to go before there is a sufficient archive of strontium signatures to allow anything more than provisional insights into ancient lives. For example, between A.D. 1400 and 1532, the Inca of the Cuzco Basin forcibly moved people to new locations, for state needs and also as a result of conquest. Preliminary analysis of burials from the Chokepukio site near Cuzco shows that people came from widely separated locations, with more female immigrants than males, as women were relocated for marital reasons or so they could serve the state in ceremonial functions (Andrushko et al., 2009). One has the impression of a diverse population reconfigured as a result of Inca imperial policies.

Another example, this time from Southeast Asia, shows how strontium is beginning to write ancient life histories. The Ban Chiang cemetery in northeast Thailand contains ten phases of human burials grouped in three periods between 2100 B.C. and A.D. 200. They were interred during a period of some 2,000 years, covering the transition from hunting and gathering to agriculture in Southeast Asia. But did these people live their lives in one place? A sample of burials provided strontium and carbon and oxygen isotopes from second and third molars. At Ban Chiang, there were striking differences between the men and women. The males displayed considerable variation, while the women tended to remain constant. The researchers believe that this pattern reflects a society that was matrilocal: The women stayed in one place, while the men were often absent on hunting expeditions or married into sedentary settlements inherited through the female line (Bentley et al., 2005).

Forensic Archaeology: The Archaeologist as Detective

Archaeologists sometimes call themselves time detectives, which is a legitimate way to describe scientists who spend their careers delving into the behavior of long-vanished societies. In recent years, the detective work has expanded in new directions as modern-day police work becomes ever-more sophisticated. **Forensic anthropology** has become a cutting-edge specialty, thanks, in part, to much more rigorous investigative procedures, and also thanks to high-technology medical science, which allows criminal investigators to work with ever more

fragmentary evidence, much of it excavated from graves and from subsurface contexts. From forensic anthropology to forensic archaeology is but a short step, for the meticulous, slow-moving techniques of scientific excavation are profoundly relevant to many crime scenes.

A small number of archaeologists now train police officers in archaeological methods, through programs such as the one run by the University of Oklahoma field school, which teaches police officers stratigraphic interpretation, the recovery of fragile objects and friable bones, and other basic methods. Archaeologists have been called in to excavate major war crimes, including mass graves in Kosovo and in Iraq, where their expertise with cemeteries is extremely useful. Teams of excavators have also investigated MIA (missing in action) crash sites in Vietnam and even investigated an Alabama cemetery where graves had been illegally disturbed for new burials since 1858.

As an offshoot of such work, Richard Gould of Brown University has formed disaster response teams, who work to recover human remains and other evidence from such sites as the World Trade Center and a nightclub in Providence, Rhode Island, destroyed by a catastrophic fire.

Genetics and DNA

Ever since the identification of the ABO blood system in the early twentieth century, genetics has had a profound effect on the study of human evolutionary history (Sims-Williams, 1998). Modern molecular biological techniques have made it possible to detect and analyze new polymorphic genes (genes present in slightly different forms in different people) that might have medical or anthropological interest. All humans carry in their genes the record of their history.

Most of our genetic information is in the form of 46 chromosomes inside the nuclei of each cell in our bodies. This nuclear DNA is easy to study in living populations, but degrades quickly and is no longer intact when a body decomposes. In recent years, studies of mitochondrial DNA (mtDNA) present outside the cell nuclei in small structures called mitochondria have attracted particular attention. MtDNA is useful when studying the past because it has three distinctive properties: (a) It is preserved in thousands of copies in each cell; (b) it is inherited

through the female line and is passed from mothers to offspring virtually unaltered except for rare changes caused by mutation; and (c) it changes at a steady rate and in a distinctive way, being transferred from one generation to the next intact, changing through time only as a result of random mutations. MtDNA changes faster than nuclear DNA, so much so that it has been used as a clock for dating such major events as the appearance of modern humans. Large-scale studies of human mtDNA in present-day populations from all parts of the world have shown that there is relatively little mtDNA variation throughout the globe, suggesting that there was a relatively recent branching-out of human populations. The African mtDNAs were the most variable, having had more time to accumulate genetic changes, consistent with the theory that the African human lineages are the oldest ones.

Current research demonstrates that *Homo sapiens* evolved in Africa then spread into other parts of the Old World and eventually to the Americas. MtDNA research on American populations links them to Siberian ancestors, as one might expect. A recent study of over 4,000 male skulls from 105 worldwide populations has shown that African crania show much less variation than those from elsewhere, a conclusion that tends to confirm the genetic evidence.

The first ancient DNA sequences were reported by Swedish scientist Svante Pääbo, who extracted and characterized DNA from the skin of a Predynastic Egyptian of about 4000 B.C. in 1985. Since then, DNA has been extracted from bones, teeth, and plant remains using a new technique called polymerase chain reaction (PCR). Pääbo used this technique on a human brain of 3000 B.C. from a hunter-gatherer site at Windover, Florida, and identified an mtDNA strain not previously observed in North America. In recent years, scientists have succeeded in extracting DNA from a Neanderthal bone over 50,000 years old and have shown that these Archaic Europeans were genetically distinct from the modern humans who succeeded them. Mitochondrial DNA analysis of ancient human skeletons from Easter Island in the Pacific has also shown that the ultimate origins of the Easter Islanders lie in Polynesia, for this remote landmass had been colonized from the Society Islands (the Tahiti region) in about A.D. 1200.

Molecular biology is assuming an increasingly important role in the multidisciplinary study of the human past (Wells, 2002), not only in

humans but also in dogs, rats, and chickens. A recent study of the genetics of Andean chickens found a century before Columbus landed in the Bahamas has shown that they share an identical genetic signature with that of Polynesian chickens, strongly indicating at least sporadic contact between Polynesia and South America before Columbus and Francis Pizarro (Matisso-Smith et al., 2007; Storey et al., 2011).

Groups: Ancient Social Organization

Humans interact with one another as individuals and as groups—family, household, community, and so on. They also live in societies with varying degrees of social organization that radically affect their lifeways. Reconstructing ancient social organization is of vital importance to archaeologists. Research into prehistoric social organization is concerned with two basic questions: the size or scale of the society and how it was organized.

Stages of Social Organization

Questions of social scale are important, for they enable the archaeologist to examine not only the complexity of individual societies but also the ways in which they interact with others. Archaeologists look at social organization in prehistory with the aid of general conceptual schemes drawn up by anthropologists. Such schemes are particularly important when examining human cultural evolution. Anthropologist Elman Service, in his classic *Primitive Social Organization* (1971), defined several broad levels of sociocultural evolution that have provided a general framework for tracing the evolution of human social organization from the first simple family structures of the earliest hunter-gatherers to the highly complex state-organized societies of the early civilizations.

All theories of cultural evolution are based on the premise that human societies have changed over long periods of time and that the general trend throughout the past has been toward a greater complexity of human culture and social institutions. Service divided human societies into bands, tribes, chiefdoms, and states, a classification that

has won wide acceptance but is much criticized for its arbitrary rigidity. Because this is a complex and controversial issue, many archaeologists prefer a broader grouping, into which Service's categories fall.

Pre-state societies are societies on a small scale, based on the community, band, or village. They vary widely in their degree of political integration and can be divided into three categories:

1. **Bands** are autonomous and self-sufficient groups that usually consist of only a few families. They are egalitarian, with leadership coming from the experience and personal qualities of particular individuals rather than from political power.
2. **Tribes** are egalitarian, as are bands, but tribes have a greater level of social and cultural complexity. They have developed kin-based mechanisms to accommodate more sedentary living, to redistribute food, and to organize some communal services. Some more complex hunter-gatherer societies, including the Pacific Northwest groups, can be classified as tribal; most were associated with village farming. In egalitarian societies, public opinion plays a major role in decision making.
3. **Chiefdoms** are societies headed by individuals with unusual ritual, political, or entrepreneurial skills, and are often hard to distinguish from tribes. Society is still kin-based, but it is more hierarchical, with power concentrated in the hands of powerful kin leaders. Chiefdoms tend to have higher population densities than tribes and to display signs of social ranking, reflected in more elaborate material possessions. The degree of elaboration varies greatly and depends on many factors, including the distribution of population over the landscape. Tahitian chiefs presided over powerful, constantly quarreling chiefdoms, frequently waging ferocious wars against their neighbors. The elaborate Mississippian chiefdoms of the American Midwest and South flourished during the early second millennium A.D. and maintained extensive trade networks and ritual contacts over long distances.

The term *chiefdom* is highly controversial and varies greatly in its definition (Earle, 1991; Yoffee and Sherratt, 1993). Current thinking considers it basically a political unit in which local

autonomy at the village or band level has given way to a form of authority in which a paramount chief controls a number of settlements. Chiefdoms organize regional populations, and their form of social stratification and social inequality is less than that of early states, to which they are an alternative trajectory of social development.

State-organized societies operate on a large scale, with centralized social and political organization, class stratification, and intensive agriculture. They have complex political structures, many permanent government institutions, and firm notions of social status (Fagan and Scarre, 2017).

A state-organized society is governed by a full-fledged ruling class whose privileges and powers are supported by a hierarchical secular and religious bureaucracy, at least a rudimentary system of justice, and a system of ranked classes of nobility, warriors, traders, priests, bureaucrats, peasants, and perhaps slaves. The ruler enjoys great wealth and is often regarded as semidivine. Egyptian pharaohs were divine monarchs with absolute powers. Ownership of land and administration of state religion were vested in their hands. The pharaohs ruled by centuries of legal precedent, through an elaborate hierarchy of bureaucrats, among whom the principal officials represented practically hereditary dynasties (Kemp, 2006). Many state societies, such as those of the Maya and the Inca, were organized along rigid lines, with strict classes of nobles, craftsmen, and others. Only the most extraordinary act of military skill or religious devotion would allow a few lucky people entry into the highest classes of society (Townsend, 2009). All the people knew exactly where they stood in society, even slaves. State-organized societies were the foundation of the early civilizations of southwestern Asia, China, and the Americas; indeed, they were precursors of the Classical civilizations of Greece and Rome.

Social Ranking

Social inequality has been a feature of human life since the first appearance of farming some 10,000 years ago, and it had been institutionalized in civilization before 3000 B.C. **Social ranking** (social distinctions between individuals, communities, and other units of

society) exists in several forms. One form consists of social distinctions between individuals (often reflected in graves), including relationships between individuals, communities, and the wider society, as discerned from the study of architecture, settlement patterns, and distributions of luxury goods such as gold ornaments (see [Chapter 11](#)). Another form lies in social diversity (ethnicity), social inequality reflected in the relationships between groups within society.

Figure 16.5 Angkor Wat, Cambodia, a symbolic depiction of the Buddhist cosmos. One approaches Angkor through an entrance gallery with a tower by a paved causeway that is 500 feet (150 m) long and is flanked with balustrades adorned with multiheaded snakes.

Source: Courtesy of Danita Delimont/Alamy Stock Photo.

Figure 16.6 Mohenjodaro, an Indus Valley city of the second millennium B.C. The widest streets were only about 30 feet (9 m) wide, lined by monotonous houses, which appear to show no social differentiation (although arguably, any poorer people may have lived outside of the main site in more temporary accommodation).

Source: Courtesy of robertharding/Alamy Stock Photo.

A variety of approaches provide insights into social ranking. Clearly, material evidence for great wealth, such as hoards of buried gold ornaments or fine drinking vessels, suggests some form of ranking that concentrated wealth in a few hands. So do elaborate palaces and public buildings, such as the Mycenaean palaces in Greece or the Sumerian temples in Mesopotamia. As were great Maya ceremonial centers such as Tikal and Palenque in Mesoamerica, many such structures were built as important symbolic statements of political, social, and religious power. Tikal, for example, is a symbolic model of the Maya spiritual world, complete with sacred mountains, trees, and caves (see [Figure 15.3](#) on page 291). Perhaps the most elaborate example of such a structure is the Khmer temple at Angkor Wat, Cambodia, a stunning depiction of the Buddhist world built at enormous expense at the behest of divine kings over a 40-year period around A.D. 1400 ([Figure 16.5](#)).

Many such monuments—for example, the Temple of the Sun God Amun at Karnak, Egypt (see [Figure 8.2](#) on page 128)—were adorned

with paintings and statues of great leaders (in this case, pharaohs), often in the presence of the gods. Accompanying hieroglyphs and small details of royal costume provide constant, symbolic reminders of royal power and divinely given authority.

Evidence of social ranking can sometimes be inferred from buildings and community layout. Teotihuacán shows every sign of having been an elaborately planned city, with special precincts for markets and craftspeople and the houses of the leading priests and nobles near the Street of the Dead, which bisected the city (see [Figure 15.15](#) on page 302). In such instances, it is easy enough to identify the houses belonging to each class in the society, both by their architecture and by the distinctive artifacts found in them.

Rank and Death

Human burials are the most important source of information about prehistoric social organization and ranking (Brown, 1971). The actual disposal of the corpse is really a minimal part of the sequence of mortuary practice in a society. Funerary rites are a ritual of passage and are usually reflected not only in the position of the body in the grave but also in the ornaments and grave furniture that accompany it. The contents of a grave, whether spectacular or extremely simple, are useful barometers of social ranking. The Egyptian pharaoh Khufu expended vast resources on building his pyramid and mortuary temple at Giza (see [Figure 16.7](#)). Thousands of laborers moved more than 2.3 million limestone blocks weighing between 1.5 and 2.5 tons to build his pyramid during his 23-year reign.

[Figure 16.7](#) The Pyramids of Giza, Egypt.

Source: Courtesy of Shutterstock.

The Egyptian pyramids were built by a highly centralized state over a period of little more than a century, at great expense of labor, food, and materials. Then, suddenly, these same resources were diverted to other works and to the provinces, as if there had been major changes in the nature of Egyptian society and government (Lehner, 2008). Archaeologists are still trying to puzzle out the social and political implications of this shift.

Sometimes the differing status of burials may indicate that a society was rigidly ranked. When Leonard Woolley excavated the Early Dynastic royal burials of Ur-of-the-Chaldees in Mesopotamia, he found a great cemetery containing 1,850 graves (Woolley, 1943). Sixteen of them stood out by virtue of their remarkable grave furniture. The royal tombs were sunk into the earlier levels of the mound, and a sepulcher consisting of several rooms was erected in the middle of a huge pit. The royal corpses were decked out in a cascade of gold and semiprecious stone ornaments; gold and silver ornaments were placed next to the biers; and several attendants had been slaughtered to accompany the dead. Once the royal sepulcher was closed, the entire court filed into the grave pit, drank poison, and lay down to die in correct order of protocol (see [Figure 16.8](#)). (Recent research hints that they may have been killed with blows to the head.) Woolley was able to identify the different rankings of the courtiers from their ornaments. In contrast to all this luxury, the average person was buried in a matting roll or a humble coffin. (It should be noted that Woolley's notes are lost and we are unable to verify the details of the funeral.)

[Figure 16.8](#) Hypothetical reconstruction of the Ur funeral.

Source: H. M. Herget/National Geographic Image Collection/Alamy.

DISCOVERY The Nubian Kings of Kerma, Sudan

Like his mentor, he believed in the importance of even the smallest artifacts. He was one of the first archaeologists to excavate in ancient Egyptian Nubia, now part of the Sudan. In 1913, he excavated a series of royal burial mounds at Kerma, the capital of a once-powerful African state in the early second millennium B.C.

The kings lived in considerable state and went to their deaths in great splendor. Reisner described royal burial mounds with large numbers of small chambers that contained many sacrificial victims. Using the stains on the room floors, Reisner estimated that at least 400 people had been killed alongside one dead ruler, all of them, including members of his immediate family, on the same day. Reisner theorized that the victims had entered the small chambers, had lain down in a position of rest, and had then been buried alive. Many of the bodies lay in attitudes that

communicated fear, resignation, and the kinds of convulsions resulting from death by slow suffocation. The adults lay mainly in restful positions, but some young females had crawled under beds and other furniture, there to perish slowly in stagnant air pockets. Some of the dead had held their head in their hands or put it between their thighs. Some clasped one another. Reisner argued that the act of sacrifice was a gesture of loyalty, of comfort and continuity that assured the continuation of a royal life in eternity.

Reisner (1923) wrote a vivid account of the ululation and chanting as the funeral procession wended its way to the mound (see [Figure 16.9](#)). The royal corpse was laid in its chamber, the fine grave offerings laid out in order as the ruler's wives and attendants took their places in the chambers, "perhaps still with shrill cries or speaking only such words as the selection of their places required." Then, at a signal, the waiting crowd cast baskets of sand into the open chambers and onto the still, but still-living, victims on the floors. As the sand rose in the mound, there was a "rustle of fear" that passed through the dying as hundreds of baskets masked them from view. The crowd now feasted on the hundreds of cattle slaughtered in honor of the dead ruler, butchering the beasts and cooking the meat to the west of the tumulus and placing the skulls in a great crescent on the south side of the mound. Reisner's imaginative reconstruction was based on acute observation and careful excavations.

Figure 16.9 A royal tomb at Kerma. People rush to complete the mound as burial takes place.

In burials like pharaohs' graves, and even in burials of Iron Age chieftains in Europe, the ranking of society is obvious. But what can we learn about less affluent societies, in which differences in rank and social status are often more muted? It is very important for archaeologists to be able to recognize such inequalities, for the degree of social ranking is often a measure of the size and complexity of a society. Very often, too, rank appears when centuries-old ties of kin and family are being replaced by rulers who preside over much more elaborate social systems. Brown (1981) pointed out that such variables as age, sex, personal ability, personality, and even circumstances of death can affect the way in which one is buried. The evidence for ranking comes not

only from grave furniture and insignia of rank deposited with the deceased but also from the positions of graves in a settlement or cemetery and even from symbolic distinctions that are hard to find in the archaeological record (O'Shea, 1984). (See the Discovery box.) In general, however, the greater and more secure a ruler's authority, the more effort and wealth are expended on burial. This lavishness may also extend to immediate relatives and friends (Chapman et al., 1981).

Figure 16.10 (a) Peebles's pyramid-like social hierarchy of Moundville burials based on the analysis of more than 2,000 graves. Artifacts listed against individual skeletons are grave goods found with them. (b) Aerial view of Moundville.

Source: Courtesy of RosalreneBetancourt/Alamy Stock Photo.

Burial analysis on a large scale can be particularly revealing. The Mississippian ceremonial center at Moundville, Alabama, was in its heyday in the thirteenth and fourteenth centuries A.D. More than 20 mounds topped by temples and elite residences lay inside a wooden palisade covering 370 acres (150 ha) on the banks of the Black Warrior River. More than 3,000 burials have been excavated at Moundville. Archaeologist Chris Peebles (1987) combined a pottery seriation of vessels found with a sample of the burials with a cluster analysis of more than 2,000 graves as a means of grouping them by social rank. Peebles found that the highest-ranking people were buried in or near the earthen mounds with elaborate grave furniture, including copper artifacts. A second group had fewer grave goods and were not buried in mounds, and the lowest-ranking people were buried at the edge of the site with almost no grave furniture. Peebles also developed a social hierarchy for Moundville that was headed by seven burials, all of them males (see [Figure 16.10](#)).

Studying ancient social organization will never be easy in the absence of written or oral records, but the archaeology of death provides a fruitful avenue of inquiry.

Gender: (Beyond) Men and Women

Archaeologists have long studied people and households, but only over

the past few decades have they turned their attention to the complex issue of gender and gender relations, a stimulating avenue of research (Gero and Conkey, 1991).

Initially, many felt gender studies overlapped with feminist archaeology with the latter's explicit aim of redressing archaeology's male-centered bias (whether in the interpretation of the past, or in appointing women to senior archaeological positions). In fact, gender studies go way beyond the study of women by women. Current researchers are interested not only in investigating changing gender relations and roles, but they also seek to deconstruct our socially conditioned perceptions of gender.

But what is gender? It's not the same as sex. Sex is biologically determined (at its most common: male or female). Gender is the socially and culturally constructed behavior associated with one's sex. Thus, the **archaeology of gender** attempts to deal with culturally and temporally specific ideologies of gender, with roles and gender relations—the ways in which gender intersects with all aspects of human social life. How were roles and social relationships constructed? And if so, what contributions did the various genders make to ancient societies? (Gero and Conkey, 1991; Joyce, 2009; Nelson, 1997). An **engendered archaeology** uses a wide diversity of archaeological methods and approaches to find how out gender “worked” in ancient societies, to unravel its cultural meanings (see the Doing Archaeology box).

Doing Archaeology Grinding Grain at Abu Hureyra, Syria

Farmers' bones reveal telling secrets about gender roles. The Abu Hureyra farming village in Syria is one of the earliest known agricultural settlements in the world (Moore, 2000). In about 10,000 B.C. , the inhabitants switched from hunting and foraging to growing cereal crops. A thousand years later, they founded a close-knit community of rectangular, one-story mudbrick houses separated by narrow alleyways and courtyards set in the midst of their fields. For hours on end, the Abu Hureyra women would labor on their knees, grinding grain for the evening meal, as the monotonous scraping sound of grinding corn echoed through the settlement. Thanks to some exciting detective work by biological anthropologist Theya Molleson (1989), we can be certain that women rather than men ground grain.

Molleson is an expert on human anatomy and pathological conditions in bones caused by stress and disease. She studied the many skeletons found under the Abu Hureyra houses and found that the people were remarkably healthy, except for bone deformities caused by arduous and repetitive tasks. Then she noticed that some adolescents had enlarged portions on their neck vertebrae, the result of carrying heavy loads. She also identified many knee bones with bone extensions on their articular surfaces, the result of repeated kneeling for long periods. Many people also had stressed lower back vertebrae, enlarged toe joints, and gross arthritic conditions of the big toe.

Molleson was puzzled by these deformities, until one of her colleagues visited Egypt and noticed that kneeling supplicants on the walls of ancient temples always had their toes curled forward. The only activity at Abu Hureyra that could produce the same effect was kneeling in front of the stone grinding querns found set into the house floors. Intrigued, Molleson now reconstructed the grinding process. The grinder put grain on the quern and gripped the grinding stone with both hands. He or she then knelt with the toes bent, pushing the stone forward, arms turning inward as the stone reached the end of the quern. At the end of the stroke, the upper body was almost parallel to the floor. Repeated every day, such back-and-forth movement would cause backbone damage identical to that on the skeletons, would place bending stress on the knee and hip joints, and would eventually cause arthritic conditions in the toes—all conditions found in the Abu Hureyra bones.

Next, Molleson asked who had done the grinding. She measured the first metatarsal bone of the foot. The larger male bones showed little wear, whereas the shorter women's metatarsals displayed signs of heavy wear. Molleson is virtually certain that women and girls suffered repetitive-stress injuries because they shouldered the laborious task of preparing food. This meticulous research provides clear archaeological evidence for gender-specific work, in this case, seemingly carried out by women.

Engendered Research

To engender the past means to focus not only on major material

achievements such as metallurgy or pot making or on ancient environments, but also on interpersonal relations and the social dynamics of everyday activity. These are the activities that take up most of people's daily lives—hunting, gardening, preparing meals, building houses, and so on. But gender also has an effect on trade, craft specialization, state formation, religion, and ritual—to mention only a few major human activities.

Gender research in archaeology is concerned with people as individuals, without assuming their biological sex will singularly determine their contributions to society, as the first two examples (discussed next) show. There then follow two more case studies that may test our preconceptions of sex and gender and challenge our culturally accepted dualism of male and female. As the current generation of gender archaeologists point out, the two sex/two gender model that we take for granted is an assumption. Indeed, biologists estimate that between 1 in 1,500 and 2,000 births are of children whose genitalia are not those conventionally expected for the male or female categories. Likewise, they stress that it is erroneous to assume a male/female gender model was—or even is—the reality (Joyce, 2009). After all, we all know people who are behaviorally outside our culturally normative male/female model. Let us now turn to the aforementioned case studies.

Aztec Weaving, Mexico

“The good middle-aged woman [is] a skilled weaver, a weaver of designs, an artisan, a good cook, a preparer of good food.” Thus did Franciscan friar Bernardino de Sahagun's Aztec informants describe a noblewoman's role in Mexican civilization before the Spanish Conquest. (See [Figure 16.11](#).) But this description is grossly misleading and simplistic, for it ignores the links among weaving, cooking, and child rearing (to mention only a few of women's tasks) and the wider society in which the women lived (Brumfiel, 1991). For instance, the population of the Valley of Mexico rose tenfold during the four centuries before the conquest, a striking testimony to the success of the Aztec household economy. Women wove textiles and the capes that were the badges of social status in Aztec society. Their woven products

were vital to the enormous tribute system on which Aztec civilization depended. Cotton mantles even served as a form of currency.

Figure 16.11 An Aztec woman teaches her daughter how to weave.

Source: Image by Brian Fagan.

Cloth was a primary way of organizing the ebb and flow of goods and services that sustained the state. Elizabeth Brumfiel uses archaeological evidence to refine this general picture. She shows that the women living in the Aztec capital, Tenochtitlán, turned away from weaving to cultivation of swamp gardens and the salting of fish, while weaving to satisfy tribute needs was still the dominant activity at a distance from the city. Here the burden of tribute production fell on female heads. In the city, men and women often labored away from home on food production and other activities, a shift also reflected in a change from wet foods such as stews to tortillas and other dried foods that were easily carried to a work site elsewhere.

Brumfiel shows that the roles of women in the Aztec household were much more varied than those that were attributed to them by Sahagun's informants. Furthermore, the skills of cooking and weaving were important political tools, ways of maintaining social and political control. Thus, she argues, the idealization of these skills in both Aztec folklore and schooling developed because women were makers of both valuable goods and of people. It was they who ensured the continuity of Aztec kin groups. The simplistic view of Aztec life of Sahagun's informants reflected contemporary ideology but masked the dynamic and highly adaptive role that women played in this remarkable civilization.

Sausa Gender Relations, Peru

The engendering of archaeology is an exciting development, one that will transform our interpretations of human prehistory beyond recognition in coming years. At present, however, gender studies are still in relatively rare and are based, for the most part, on extrapolations from ethnoarchaeological and ethnological data. This kind of direct historical approach can be useful. For example, it can be argued that it was women, with their detailed knowledge of botany derived from

thousands of years of plant foraging, who first deliberately cultivated native seeds such as sunflowers and sump weed in eastern North America at least 3,000 years ago (Watson and Kennedy, 1991).

In one study, Christine Hastorf (1992) used food remains to study changing gender relations in pre-Hispanic Sausa society in the Andes. The Sausa are maize and potato farmers who live in highland Peru's northern Mantaro Valley. Before the Inca took control in about A.D. 1460, the Sausa lived in local population groups of several thousand people. Their conquerors, anxious to increase maize production, dispersed them into small village settlements. Hastorf was interested in the changing social dynamics resulting from the Inca conquest. How did women's social position change as a result of the new conditions? She approached this fundamental question not by marshaling subjective evidence but by using two different approaches: the distribution of food remains in excavated settlements compared with those in modern house compounds and dietary evidence obtained by stable isotope analyses of male and female skeletons from ancient Sausa villages.

Hastorf, an expert on native plants, believes that modern studies of Sausa houses show a relationship between the distribution of plant remains in dwellings and compounds and the behavior of men and women in those households. In modern Andean households, women are responsible for food preparation and storage. Moreover, in households with male heads, Hastorf found the most diverse plant forms in kitchen areas and fewer crop seeds elsewhere in the compound where other activities took place. In contrast, a household with a female head had concentrations of crop seeds not only in the kitchen area but also on the patio, as if there were different constraints acting on preparation and food consumption.

Next, Hastorf plotted the distribution of crop seeds in pre-Hispanic compounds. The pre-Inca structures date from a time when maize was less common and of great sacred value. The inhabitants of every dwelling used and consumed a wide range of plant foods, including potatoes and many legumes. Maize occurred mostly in patio areas. It was here, Hastorf argues, that such communal activities as making beer—a commodity that was a vital part of ritual, social, and political meetings—took place. A later, Inca-period compound yielded fewer potatoes and much more maize. Here the processing of corn was more

concentrated, with little burning of corn, as if more of it were consumed as beer. Hastorf wonders if the dense and restricted distribution of maize in the later compound might reflect more intensified processing of corn by women. They were now living under Inca policies that sought a constant rise in maize production, regular taxation in the form of labor and produce, and, therefore, more restricted, intensified roles for women in support of male activities.

Hastorf now turned her attention to male and female skeletons found in the compounds. She studied the stable isotopes in bone collagen extracted from Sausa skeletons. She found that pre-Inca diets were the same for men and women, mainly consisting of quinoa and tubers, with some maize. These similar values suggest that beer was shared between men and women. Then the Inca entered Sausa society. The 21 skeletons (12 males, 9 females) from these centuries reveal a higher consumption of maize, but half the male diets were much richer in maize than were those of the women. Hastorf believes that this difference reflects changed social conditions under Inca rule. The women were processing much more maize into beer, which was consumed not by everyone but by a relatively small proportion of the males in the community. Furthermore, most men were eating more meat than were women.

The dietary differences reflect a changed political climate in which the Sausa, once small groups, were now incorporated into a larger political sphere that depended on men becoming involved in far more gatherings, rituals, and obligatory tasks, during which beer was consumed. The women worked harder, but their position outside the home was more restricted under the Inca regime. The Inca state depended on the obligatory *mit'a* tax, a service tax levied on male household heads. The most common *mit'a* tasks were agriculture and military service, performed by men, who were fed “meat and maize and cornbeer.” *Mit'a* tasks separated men and women physically, politically, and symbolically. Archaeological evidence, gathered from two sources, tends to confirm this conclusion, documents the changes in women’s position in Sausa society, and makes men and women visible in the archaeological record.

[Rethinking the Bones at Tlatilco, Mexico](#)

Since sex is biologically determined, it can be archaeologically established from skeletal remains; the gender roles can be thus extrapolated, as the previous case-studies suggest. Or maybe not. In a new generation of gender studies, archaeologists such as Emily Weglian (2001) and Rosemary Joyce (2009), question the way in which burials are interpreted.

Thus, Joyce (2009) has reassessed the burial evidence from the site of Tlatilco, on the southern edge of Mexico City, to challenge assumptions over sex and gender assignments. The excavations at Tlatilco were completed in the 1960s and among the finds were about 400 burials, dating from circa 1100–700 B.C. , that is, during the period of early village life. Some contained grave goods, such as pottery vessels, figurines, rattles, and other items.

To explain further, in the 1980s, Paul Tolstoy and colleagues investigated these burials to offer a picture of society, including the roles of men and women. To do so, as is typical for such studies, the team used the field and laboratory assignments of male/female in order to see how often men or women were included in high or lower status burials. In those cases where no biological assessment had been made in the field or lab, sex was based on the objects found in the burials that were thought to be distinctive of men's or women's roles. Tolstoy found patterns that suggested women had high status in the village and that men might have been outsiders who married into the village—in this model. Tlatilco, he concluded, was probably a matrilineal settlement where women exercised authority in the village.

Some years after Tolstoy's pioneering study, a complete catalogue of over 200 of the burials was published, which included assessments by biological anthropologists. Joyce transformed this information onto a database in order to statistically examine the patterns of burial type with sex.

“The longer I worked, the more worried I became: nothing I tested ended up being securely correlated with variation between men and women,” she writes (Joyce, 2009). In her view, only a few weak associations were apparent—such as, belts and ear spools worn by men—while necklaces were more commonly found with women.

As Joyce points out, part of the problem is that identifying sex is not as easy as is sometimes claimed. Researchers tend to use relative size of

adult skeletons, the thickness and features of the skull, and the apparent shape of the pelvis to assign bodies to “male” or “female” categories. However, it is hard to assign sex to children, and does not work where diagnostic features are poorly preserved or missing; moreover, other elements such as nutrition and levels of activity can also impact the skeleton. Consequently, rather than basing their assignation on skeletal remains, archaeologists often also rely on the items found with the body in order to assign sex, that is, they actively look for things they associate with men or women. Joyce further observes that our search for men and women may actually obscure other, more fundamental, ways in which people distinguished themselves. By revisiting her statistical analysis, she detected a much more obvious distinction—based not on sex but on age.

Thus, the highest number of objects and most unusual things were concentrated in the burials of young adults. This may have been done partly to strengthen ties between those cooperating in funeral ceremonies of those youngsters whose social ties were undeveloped, or only just beginning. She also found that the same objects were used in the burials of males and females of similar ages—for example, rattle balls were found with older men and women (which both underscores the age-related factor and demonstrates the problems of associating certain items with males or females).

So rather than seeing Tlatilco as a matriarchal society, suggests Joyce, perhaps sex was less significant than age for a basis for identification among people. Studies such as these certainly force us to question our assumptions over both sex and gender and highlight the ways in which we use our own culturally informed beliefs to interpret the past.

In a second fascinating case study, Rosemary Joyce’s work at Puerto Escondido in northern Honduras, looks at the role of ear spools in society and what they might reveal about gender ideologies (see the *Doing Archaeology* box on page 330).

These ear ornaments, once an everyday piece of material culture, were used from childhood, seemingly to help reinforce ideas of gender. As Joyce (2009) points out, it is through the repetition of actions of everyday activities, with each gender performing its own culturally specific behavior that gender differences become taken for granted and indeed naturalized.

Gender research, and much other feminist archaeology, is an extension of sound approaches that have reconstructed general trends, structures, and patterns of the archaeological record. The archaeologist acts as an active mediator of the remote past in a new generation of researches, which promise to be controversial, enlightening, and certainly fascinating.

The engendering of archaeology is long overdue and will affect not only basic research but also the ways in which we write about the past. As the earlier examples show, the research gives us the potential to go far beyond the material, to probe the subjective and the gender-driven ways in which people adapt to changing circumstances. Much of this meticulous, incredibly detailed research, and its concern for the changing dynamics of ancient society offers great promise for the future.

Doing Archaeology Ear Spools and Gender, Honduras

Puerto Escondidoisa is a small farming village in northern Honduras. When Rosemary Joyce (2009) and her team were excavating an abandoned storage pit (dated to A.D. 400) in the yard of a house, they found abundant cylindrical fragments of brown and black fired-clay rings. They quickly recognized them to be ear spools—ornaments that would have been inserted into the earlobe, gradually stretching the skin. They appear to have been part of daily life from at least 1000 B.C. to after A.D. 1500. Complete sets have been found next to skulls in burials and are depicted on clay figurines.

When the Spanish invaded in the sixteenth century they reported their use, including how ear piercing was a childhood ritual. Such rituals were one of the ways that children learned their adult roles and came to understand what was expected of their different gendered experience.

The ear spools alone did not tell Joyce and her team very much about how they, or associated ideas of gender, were regarded by society. However, it was the context in which they were found that raised interesting ideas. The fact that fragments of ear spools were discarded in a household yard, a place where people lived their everyday lives, made a difference to the interpretation; as did the precise context in which the team found these fragments. For they were found within a

pit that included all sorts of finds including skillfully decorated yet broken ceramics, vessels appropriate for serving food, and the bones of a wide range of animals, such as deer, the largest local game to be hunted. This suggests the pit was the refuse of a festive meal, served on a special occasion, and perhaps accompanying a ceremony during which the ear spools were used and disposed of.

The precise time that the ear spools were abandoned adds an extra layer: the trash pit has been dated to A.D. 400. This is in the middle of a long tradition of ear spool use that lasted for at least 2,500 years. However, while there are visual images of people wearing ear spools back to 1100 B.C. —a clue, writes Joyce, that their use was subject to public recording and commentary—archaeologists have found no such images from about 200 B.C. to A.D. 600. In other words, the trash pit was created right at time when ear spools received no public visual dialogue. Why not? And what might the discovery of the ear spools in a ritual-related trash pit in the yard of a house mean about the use of ear spools in society?

Joyce suggests that perhaps this indicates that the ritual and everyday use of ear spools was, at this time, taken for granted and naturalized. According to this model, though the spools were still the subject of rituals—albeit rituals that now appear to have been performed in the privacy of one’s back yard—people simply felt no need to depict the use of something so “normal” or everyday as the gender-reinforcing ear spools.

All archaeological interpretations—including those mentioned earlier—should be open to debate. Certainly, Joyce’s rigorously excavated site and her views on the meaning of ear spools provide much food for thought and raise interesting ideas that we might not otherwise have considered.

Though some originally dismissed this field as a sort of new archaeology “for the girls,” perhaps this shows how far gender research strikes at the very heart of our preconceptions and prejudices. It certainly produces richer, and often more challenging, readings of the past.

This focus is a reaction against approaches that minimize the importance of social power and assume that ancient societies enjoyed a high degree of cultural uniformity. In fact, many archaeological studies

have shown that culture change can occur very rapidly, at times at a speed that is well within the limits of human memory, as it does in our society (Sanders et al., 1979). Nor should one minimize the importance of social power in the appearance of early states, such as those of the Maya or Aztecs (Townsend, 2009). Despite a few studies that are now focusing on the importance of social ranking and the political power of kings and nobles, almost no archaeologists have studied the phenomenon of resistance to overwhelming social and political power and the archaeology of ethnic minorities (Jones, 1997).

Ethnicity and Inequality

For the most part, archaeologists have focused their attention on two broad topics. Culture historians have described long-lasting cultural traditions in many parts of the world, and culture ecologists and advocates of processual archaeology have studied the ever-changing relationships between human societies and their natural environments. There has also been a major preoccupation with “origins”—the first Americans, the first farmers, the origins of civilization, and so on (Hodder, 1999). In recent years, however, an increasing number of scholars have used archaeology’s unique perspective to study ethnic diversity and what is sometimes called the **archaeology of inequality**: the ways in which people have exercised economic and social power over others (McGuire and Paynter, 1991).

Ideologies of Domination

Elites have used many tactics to exercise power over others, everything from gentle persuasion to divine kingship, precedent, economic monopolies, and naked force. Perhaps most important of all are the **ideologies of domination**. The ancient Maya lords built great ceremonial centers with towering pyramids and vast plazas that were symbolic models of the sacred landscape, of the Maya universe. The Pyramids were sacred mountains, the sites of sacred openings that were the threshold to the spiritual world of the ancestors. It was here that the ruler went into a shamanistic trance, communicating with the gods and ancestors in lavish public ceremonies. Everything validated the

complex relationship between the living and the dead and between the ruler and the commoner, displayed in lavish, pointed metaphors that confirmed the divine power of the supreme lords (Schele and Freidel, 1990; see also [Chapter 17](#)).

Mark Leone and his colleagues at Historical Annapolis Foundation studied the theories of power that lay behind the planning of two major colonial settlements: Annapolis and nearby St. Mary's City in Maryland (Leone and Hurry, 1998). They argue that baroque principles of urban design were used at both locations. St. Mary's City was once thought to have been a haphazard settlement, when, in fact, archaeology has shown that the principal, brick-built buildings, like the Jesuit chapel, prison, and state house, were placed at nodes of the street system. The baroque system used lines of sight to direct people's eyes to points of reference in space that represented monarchy and social hierarchy. Maryland society was new, with a hierarchy of businessmen and officials who used such principles of urban planning to foster their social status (Leone, 2005).

Likewise, in Annapolis, in 1696–1710, Governor Francis Nicholson redesigned the original Anne Arundel Town, a settlement of some 200 people, with a master plan of two circles, with streets radiating from them, and a large square, all placed on a series of hills and ridges. The present-day state house and circle are still the focus of Annapolis. Archaeological excavations, geographic information system (GIS), and computer-assisted drawing (CAD) plots have shown that the circle was, in fact, egg-shaped, an artifice necessary to integrate sloped hillsides and hilltops into an overall design that appeared to be a circle. At the same time, Nicholson used diverging sides for the radiating streets so as to give someone approaching the state house the optical illusion that it was larger and closer, adding to the impression of power. This baroque town planning may be connected to the landscape architecture of terraced gardens used by prominent Annapolis residents in later decades (see [Figure 15.18](#) on p. 309).

[Artifacts, Social Inequality, and Resistance](#)

Political power and social power are extremely heterogeneous phenomena that are exercised in many forms. From the archaeologist's

point of view, it is fascinating that one can use material objects such as pottery to study how people negotiated their social positions and resisted the submergence of their own culture (Beaudry et al., 1991; Orser, 2016; Singleton, 1999). Artifacts offer a unique way of examining the history of the many communities that kept no written records but expressed their diverse feelings and cultures through the specific artifacts and commodities that they purchased and used.

Fascinating studies of people's resistance to the submerging of their culture are coming from the American South, where the earliest Africans to reach North America brought their own notions of religion, ritual, and supernatural power to their new homes. "The Guinea negroes had sometimes a small inclosure for their god house," wrote one Florida plantation owner in 1839 (Ferguson, 1992: 65). They even maintained small shrines in their living quarters. Historical records rarely refer to such shrines, but archaeologists have found blue beads and other charms at many slave sites in the North American Southeast. At the Garrison and Kingsmill plantations in Maryland and Virginia, engraved pewter spoons bear motifs remarkably similar to those executed by African Americans living in Suriname in South America at the same date. Bakongo-style marks like those made in Central Africa have come from bowls found in other southern sites (Ferguson, 1992; Kelso, 1984). In New York, a slave dwelling attached to the Lott House in the heart of the city housed 12 slaves until 1810. A cramped garret beneath the floor boards yielded five corncobs arranged in a cross or star pattern, a cloth pouch, and other paraphernalia of Hoodoo, a North American variant of Vudon, a cult from West and West Central Africa.

Slave plantations were part of complex networks that linked planters to other planters, planters to slaves, and slaves to slaves on other plantations. It is significant that slaves within these harsh, oppressive, and racist environments were able to maintain important elements of their own culture. Despite such conditions, African Americans maintained their own beliefs and culture, which they melded over the generations with new ideas and material innovations from their new environment. They believed that their culture, their way of living—everything from cuisine to belief systems—was the best way. African spiritual beliefs in all their variety were highly flexible and were often responses to outside influences, whether political, religious, or

economic. Thus, existing spiritual beliefs adapted readily to the new American environment, adopting new artifacts or modifying existing ones over the generations. For example, archaeologists working at Thomas Jefferson's Monticello estate have recovered crystals, pierced coins, and other ritual artifacts from Mulberry Row, where his slaves resided.

Since 1990, Mark Leone and the Archaeology in Annapolis project have excavated seven major sites where African Americans lived, dating from the eighteenth to twentieth centuries (Leone et al., 2001; Ruppel et al., 2003). They asked African American community members what they wanted to know, to which one reply was "what was left from Africa?" The answer came in the form of over a dozen artifact bundles dating between 1720 and 1920 buried in buildings owned by wealthy white owners throughout Annapolis. Such caches lay under chimney bases or hearths, in the northeast corners of rooms, and around doorways. These are ritual bundles of pins, nails, perforated discs like buttons, coins or shells, rings, potsherds, pebbles, glass fragments, and crystals.

The Brice House, a Georgian mansion in Annapolis, yielded an oval of artifacts some 9 feet (2.7 m) across under a laundry and kitchen, including dolls, buttons, and discarded matchsticks. Using historical literature and ethnographic research from West Africa, the researchers were able to decipher some of the meanings and associations of the caches, which were sometimes arranged on X-shaped axes—*cosmograms*, or circles of life. Autobiographies of former slaves, collected during the Great Depression, produced firsthand accounts of religious practices. The caches included protective charms and artifacts used in what has been called a "sacred pharmacopia."

An intact bundle, a clay container about the size of a football recently came from a depth of 3.9 feet (1.2 m) in Annapolis's Fleet Street, near the state capitol building. Part of a stone ax projected from it. While being excavated, a corner of the bundle split open, exposing iron nails and pins inside. X-rays revealed a jumble of iron nails and copper pins, also lead shot. The 10-inch-high (25 cm) container bore impressions of the cloth or leather that once formed the outer wrapping of the bundle. Pottery found nearby dates the bundle to about A.D. 1700. Interestingly, it once lay in a street gutter, which is a strange place for a

supposedly clandestine object. Experts are puzzling over the bundle. Stone ax blades were symbols of Shango, the god of thunder and lightning among the Fon and Yoruba of Benin. Metal worked in fire had, and still has, powerful associations for the Mande, Yoruba, and other West African peoples, which may be why the nails and pins were sealed inside clay. Sacred bundles are still widely used by traditional practitioners in West Africa, a way of rallying spiritual powers at times of personal crisis. Presumably the Annapolis bundle belonged to a recent immigrant, who still valued the spiritual beliefs of his or her homeland. This remarkable discovery gives powerful validation of the importance of ritual activity in early African-American communities.

Ritual bundles are believed to be part of West African spiritual practices (Leone and Cuddy, 2007). They act on the principle that spirits exist, and that they exist to be used—to cure disease, to keep violent masters at bay, to draw out malevolent spirits, and to protect. The spirit was in the ritual bundle and one had to behave as the bundle directed. The artifacts in the bundle provided a means to enter and exit a user's body. Such rituals were a powerful way to resist against a hostile world, part of what has been called "crossroads thinking," places where the living and spiritual worlds meet, a widespread belief in West Central Africa. (For a full discussion of crossroads thinking and African American garden landscapes, see Ruppel et al., 2003.)

Traditional practitioners operated in a hostile environment, so they were careful to disguise their activities. At the Levi Jordan cotton and sugar plantation in southern Texas, archaeologists Kenneth Brown and Doreen Cooper excavated a cabin occupied by an African American healer-magician. The cabin yielded animal bones, iron spikes, and other artifacts that were part of the paraphernalia of a traditional West African healer. But the same simple artifacts had other uses, too, so much so that an outside observer would not suspect that their owner was engaged in traditional medicine (Brown, 1995). To the African American workers on the plantation, the same objects had an entirely different symbolic meaning that was not revealed to outsiders. For this reason, none of the healer's tools-in-trade bore any telltale symbolic decoration that might reveal their true purposes.

African archaeologists and historians have pointed out that the sheer diversity of West African cultures makes it foolhardy to make direct

comparisons between African American and African artifacts. But the survival of African beliefs and culture in African American society is well documented as a general phenomenon and has persisted into recent times. All these finds suggest that African Americans maintained their own distinctive culture in the face of repressive slavery. They were disenfranchised from white people in their own villages and slave quarters to the point that their masters and mistresses may well have been more like parts of their environment than key players in their social lives (Orser, 2016). In South Carolina and Georgia, slaves even spoke a distinctive African American language. Children growing up in this culture used material objects such as earthen bowls that were made by members of this culture and heard stories of magic and religious chants that were important ways of establishing African American identity, maintaining ideological power, and molding values. Although many slaves may not have resisted their inferior, white-bestowed social status on a day-to-day basis, most did ignore European American culture in favor of their own and rejected an ideology that rationalized their enslavement.

Historical archaeologist Leland Ferguson (1992) has documented this resistance in South Carolina, where, in A.D. 1740, blacks outnumbered whites by almost two to one, and one-half of that majority was African born. Here, as elsewhere along the South Atlantic coast, African women arrived with a knowledge of pot making that they used to fashion domestic wares in their new homes. Their distinctive unglazed earthenware products are found in slave quarters, on plantations, and in cities. Once considered Native American pots that had been traded to slaves, these wares were actually the products of complex demographic and cultural forces that resulted from interactions between blacks and whites and between both of those groups and Native Americans. Ferguson undertook a study of this “Colono Ware” from the Southeast, focusing on complete vessels recovered from all manner of locations, including slave quarters, free Native American villages, plantations, and missions. He found that what he calls the “container environment” of South Carolina consisted of wood, basketry, and earthenware manufactures broadly similar to those of the slaves’ African homeland. Not only that, but the bowls and other vessels mirrored basic eating habits in Africa, for they were used for preparing and serving

carbohydrate porridges with a vegetable or meat relish on the side.

Ferguson believes that African American eating habits were quite similar to those of the peoples of West Africa and were radically different from those of the European Americans around them. Colono Ware is remarkably similar over a large area, made by people living in an ethnic environment where reciprocal relationships with one another were of vital importance and where there were strong ties to ancestral African culture. It was, Ferguson says, an unconscious resistance to slavery and the plantation system. The development of southern culture, he concludes, was a long process of quasi-political negotiation. It is exciting that one can use archaeology to look at the early stages of this complex process of negotiation from both sides.

Another fascinating chronicle of ethnic resistance comes from an archaeological investigation of the route taken by a small group of Northern Cheyenne when they broke out of Fort Robinson, Nebraska, on January 9, 1879. They fought a running battle with the garrison, across the White River, up some bluffs, and into open country, where it took the military 11 days to capture them (McDonald et al., 1991). This much is beyond controversy, but the route that the Cheyenne took out of the river valley is disputed. According to military accounts, the escaping party moved up an exposed sandstone ridge to reach the bluffs. This exposed route was illogical, indeed foolhardy, for there was a full moon. Cheyenne oral traditions insist on another route to the bluffs through a well-protected drainage that would have offered excellent cover from pursuing riflemen.

Archaeologists from the University of South Dakota Archaeology Laboratory investigated the escape routes with the collaboration of local Cheyenne representatives. They used random shovel testing and metal detectors to search for spent bullets in three areas: two drainages and the exposed ridge mentioned in military accounts. The survey recovered no bullets from the exposed ridge but did find them in the drainages, thereby confirming the oral account of the Cheyenne Outbreak. This may seem like a footnote to modern history, but it is important to remember that the outbreak has become a classic story of the American West from the white perspective, immortalized by John Ford's movie *Cheyenne Autumn*. This film tells the story from the victors' perspective and is a form of moral tale of the Old West. Now

oral tradition and archaeology have shattered part of the myth, telling the story from the Native American perspective in circumstances in which science has helped fashion a mosaic of the recent past that is the historical truth rather than myth.

S i T E > War Casualties at Thebes, Egypt, c. 2050 B.C. <

Few tales of ordinary people are as vivid as that told by a remarkable discovery made by Egyptologist Herbert Winlock (1942) in a sepulcher close to the tomb of the Middle Kingdom pharaoh Mentuhotep (2061–2010 B.C.) at Thebes in 1911. Sixty soldiers killed in battle were stacked in the tomb. They were dressed in linen shrouds, and their dried-out bodies were so well preserved that they began to decay when removed from the tomb. Winlock used biological and archaeological data to reconstruct their last battle. All the soldiers were young men in the prime of life, each with a thick mop of hair bobbed off square at the nape of the neck. All had perished in an attack on a fort, for their wounds had come from arrows shot from above or from crushing blows from stones thrown down from a fortification. Pictures from the time show attackers sheltering under thin shields as they attempt to breach the defenses under a rain of missiles. In this case, the fire was too fierce, so the men ran out of range. Some of them were overtaken by a shower of arrows. At least one was hit in the back with an arrow that came out on the other side of his chest. He pitched forward. The slender reed shaft broke off as he fell and bled to death. The defenders now sallied forth and mercilessly clubbed at least a dozen wounded men to death with heavy blows. Then, waiting vultures and ravens descended on the corpses and worried away the flesh with their beaks. A second attack was successful, for the torn bodies were recovered and buried with honor in a special tomb next to their pharaoh.

We do not know where the attack took place, but it was somewhere in Egypt, for the arrows that killed the attackers were of Egyptian design. Few discoveries make such a powerful statement about the lives of the anonymous players of the past.

Some of the most compelling studies of ethnic minorities' resistance to social domination come from the United States, from historical sites where written records amplify the archaeological record in important ways. As so often happens, methods developed on historical sites will

ultimately be applied to prehistoric situations. What, for example, was the position of Oaxacan merchants living at Teotihuacán, Mexico, in A.D. 600 (Paddock, 1983)? Were they treated differently from citizens of the city? Does their material culture reflect carefully orchestrated responses to the dominant culture around them? What was the lifeway of slaves and workers in Egypt? (See the Site box.) How did their relationships with their noble masters change through, say, the New Kingdom (Kemp, 2006)? Current examples of ethnic minorities' resistance may help us find some answers to these kinds of questions.

Archaeology, with its rich potential for studying the mundane and the trivial, the minutest details of daily life, is an unrivaled tool for the dispassionate study of social inequality and ethnicity. It also studies broader interactions between people and groups through artifacts passed along exchange and trade routes.

Exchange and Trade

Our lives, like those of the ancients, are a constant process of interaction and negotiation: between friends, family members, households and communities, communities and their neighbors, and entire societies. The study of such interactions in the past involves sophisticated research into trade and exchange, the mechanisms by which people and cultures bought and sold, gave or bartered goods and commodities with one another (Brumfiel and Earle, 1987; Earle and Ericson, 1977; Ericson and Earle, 1982; Masson, 2005).

Many Americans drive Japanese cars. French teenagers like the taste of hamburgers. Pacific Islanders crave Mexican-made television sets. We live in an international world, where economic ties link nations many thousands of miles apart, and as time progresses, those links are getting ever more enmeshed (Kelly, 2016). Over the past 2,000 years, and especially during the European Age of Discovery after A.D. 1500, human societies throughout the world have become part of a vast web of economic interconnectedness (Wolf, 1984). But the ultimate roots of our modern-day global economic system date back more than 5,000 years, to the dramatic growth of long-distance trade that preceded the appearance of the world's first civilizations in Egypt and Mesopotamia.

Exchange systems were part of human life long before the

Sumerians and ancient Egyptians. Shells from the Black Sea appear in late Ice Age hunting encampments deep in Ukraine from at least 18,000 years ago. The Paleo-Indians of the Great Plains exchanged fine-grained toolmaking stone over long distances as early as 10,000 B.C. Few human societies are completely self-sufficient, for they depend on others for resources outside their own territories. And as the need for raw materials or for prestigious ornaments increased, so did the tentacles of exchange and trade between neighbors near and far. This trade often had powerful political or symbolic overtones, conducted under the guise of formal gift giving or as part of complex exchange rituals.

Exchange and trade have been defined as the “mutually appropriative movement of goods between hands” (Renfrew, 1975). People make trade connections and set up the exchange systems that handle trade goods when they need to acquire goods and services that are not available to them within their own site-catchment area. The movement of goods need not be over any great distance, and it can operate internally, within a society, or externally, across cultural boundaries—within interaction spheres. Both exchange and trade always involve two elements: the goods and commodities being exchanged and the people doing the exchanging. Thus any form of trading activity implies both procurement and handling of tools and raw materials and some form of social system that provides the people-to-people relationships within which the trade flourishes. Not only raw materials and finished objects but also ideas and information passed along trade routes.

Conventionally, exchange and trade are recognized in the archaeological record by the discovery of objects exotic to the material culture or economy of the host society. For instance, glass was never manufactured in sub-Saharan Africa, yet imported glass beads are widespread in archaeological sites of the first millennium A.D. (Connah, 2001). Until recently, such objects were recognized almost entirely on the basis of style and design—the appearance of distinctive pottery forms far from their known points of origin, and so on. Sometimes exotics such as gold, amber, turquoise, or marine shells, commodities whose general area of origin is known, provide evidence of long-distance exchanges. Between 5,000 and 2,000 years ago, Late Archaic and Woodland peoples in the North American Southeast used native copper from outcrops near Lake Superior and conch shells from the

Gulf Coast, both commodities of known origin (Baugh and Ericson, 1994).

In the early days of archaeology, such exotica were deemed sufficient to identify trade, as well as what were loosely called “influences” or even “invasions.” The assumptions made about the nature of human interactions were very limited and never precise (Torrence, 1986). Today, however, studies of prehistoric exchange are far more sophisticated due to two major developments. The first is a new focus throughout archaeology on cultural process and on regional studies. The second is the development of a wide range of scientific techniques that are capable of describing the composition of certain types of raw material and even of identifying their sources with great precision.

Types of Exchange and Trade

Exchange can be internal, within a society, or external, with other groups. Internal distribution of artifacts and commodities is commonplace even in the least complex societies.

Gift Exchange Much internal exchange is **gift exchange**, or gift giving. Perhaps the most famous example is that of the *kula* ring of Melanesia in the southwestern Pacific. An elaborate network of gift exchanges passes shell necklaces in one direction, arm shells in the other. They are passed as ceremonial gifts from one individual to another, in gift partnerships that endure for decades. These gift exchanges enjoy great prestige, yet serve as a framework for the regular exchange of foodstuffs and other more day-to-day commodities. With all gift exchange, much depends on the types of commodities being exchanged. In the case of the *kula* ring, precious seashell ornaments pass between individuals of high status; foodstuffs are a more common form of transaction involving many individuals and families. And, of course, not only objects but also information can be exchanged, and the exchange of information may lead to technological innovation or social change.

Gift giving is a common medium of exchange and trade in societies that are relatively self-supporting. The exchange of gifts is designed primarily to reinforce a social relationship between both individuals and groups. The gifts serve as gestures that place obligations on both parties. This form of exchange is common in New Guinea and the

Pacific and was widespread in Africa during the past 2,000 years, as well as in the ancient Americas. Gift giving and bartering formed a basic trading mechanism for millennia, a simple means of exchanging basic commodities. But this sporadic interaction between individuals and communities reduced people's self-sufficiency and eventually made them part of a larger society whose members were no longer so self-sufficient and who depended on one another for basic commodities and for social purposes.

Reciprocity Reciprocity is the mutual exchange of goods between two individuals or groups; it is at the heart of much gift giving and barter trade. It can happen year after year at the same place, which can be as humble as someone's house. Such central places become the focus of gift giving and trade. When a village becomes involved in both the production of trade goods and their exchange with other communities, it will probably become an even more important center, a place to which people will travel to trade.

Redistribution Redistribution, the distribution of goods or commodities received by an individual through a community or group, of trade goods throughout a culture, requires some form of organization to ensure that it is equitable. A redistributive mechanism may be controlled by a chief, a religious leader, or some form of management organization. Such an organization might control production of copper ornaments, or it might simply handle distribution and delivery of trade objects. Considerable social organization is needed for the collection, storage, and redistribution of grain and other commodities. The chief, whose position is perhaps reinforced by religious power, has a serious responsibility to his community that can extend over several villages, as his lines of redistribution stretch out through people of lesser rank to the individual villager. A chief will negotiate exchanges with other chiefs, substituting the regulatory elements of reciprocal trading for a redistributive economy in which less trading in exotic materials is carried out by individual households.

Prehistoric exchange was an important variable that developed in conjunction with sociopolitical organization. In many areas, external trade proceeded from simple reciprocal exchange to the more complex

redistribution of goods under a redistributor. In other words, trading is closely tied to growing social and political complexity, although it does not necessarily imply the special production of exotic artifacts specifically for exchange.

There are other forms of redistribution, notably of food and prestige objects to fellow members of an elite, while those who produce such goods remain self-sufficient. Redistribution can also become tribute, as was the case with large empires like those of the Aztecs or Incas, which had elaborate tribute systems that supported political bureaucracies and provided such facilities as military protection in exchange. Such forms of redistribution functioned in some complex societies alongside market exchange.

Markets The term **market** covers both places and particular styles of trading. The administration and organization encourage people to set aside one place for trading and to establish relatively stable prices for staple commodities. This stability does not mean regulated prices, but some regulation is needed in a network of markets in which commodities from an area of abundant supplies are sold to one with strong demand for the same materials. The mechanisms of the exchange relationship, particularly, require some regulation (see the Discovery box).

Markets are normally associated with more complex societies. No literate civilization ever developed without strong central places where trading activities were regulated and monopolies developed over both sources of materials and trade routes themselves. Successful market trading required predictable supplies of basic commodities and adequate policing of trade routes. For example, most early Mesopotamian and Egyptian trade was riverine, where policing was relatively easy. When the great caravan routes opened, political and military issues—tribute, control of trade routes, and tolls—became paramount. The caravan, predating the great empires, was a form of organized trading that kept to carefully defined routes set up and maintained by state authorities. The travelers moved along these set routes, looking neither left nor right, bent only on delivering and exchanging imports and exports. These caravans were a far cry from the huge economic complex that accompanied Alexander the Great's army

across Asia or the Grand Mogul's annual summer progress from the heat in Delhi to the mountains, which moved a half-million people, including the entire Delhi bazaar (Polyani, 1975).

Sourcing

Studying long-distance trade involves far more sophisticated inquiry than merely plotting the distributions of distinctive artifacts hundreds of miles away from their place of manufacture. Fortunately, modern scientific technology allows us to trace the sources of many important trade materials, an approach known as **sourcing**. (For archaeological chemistry, see Price and Burton, 2011; Malainey, 2011.)

DISCOVERY Viking Silver at Spillings, Gotland, Sweden, 1999

The island of Gotland off eastern Sweden was a strategic place on the far-flung trading networks maintained by the Vikings in the Baltic Sea region of northern Europe. More than 700 hoards of valuable trade silver have come from the island during the last century alone, all of them dating to between A.D. 800 and 1140. None of them rival the silver hoard found on a farm at Spillings in 1999 and investigated by Dan Carlsson.

Viking farmers buried their wealth at a time when there was no silver currency. Once a mint was established on the island during the twelfth century, silver by weight no longer served as the basic trading currency and hoarding became less prevalent. Over the years, several hoards have come from the same farms, as if generation after generation buried their wealth on the family land. The Gotlanders were successful traders because they negotiated trading agreements to ensure that trade prospered. They were free farmers, who acted as middlemen in trade routes that linked the Islamic world to the south and east with Denmark, Sweden, and Norway.

The Spillings hoard lay under the floor of a Viking barn or storehouse, two lots of silver objects buried about 10 feet (3 m) apart, and a third collection, this time of bronze objects, about 6.5 feet (2 m) away. No signs of the containers remained, but the hoard's owners probably buried their wealth in leather, skin, or textile bags. One

deposit contained the remains of a wooden box that had once held coins. There are indications that there was a fourth batch of treasure that had subsequently been removed.

Almost all the 14,300 coins were Arabian, of which some 5,000 have been examined in detail. The earliest dates to A.D. 539, the youngest from A.D. 870 to 871. Four of the coins were minted at Hedeby, a trading center in what is now northern Germany, which was a major center of Viking trade during the first millennium A.D. Another coin was minted around A.D. 830 for Emperor Theophilus of Constantinople. Such coinage is not uncommon on Gotland, and is an indication of the wide range of Viking contacts deep into Europe and as far as the eastern Mediterranean. One counterfeit coin, copied to take advantage of the stability and value of Arab currency, came from an illegal mint, perhaps from the domains of a Khazar ruler who lived near the mouth of the Volga River, which enters the Caspian Sea. It bore an Arabic inscription: "Moses is the envoy of God."

The hoards also contained 486 arm rings, 25 finger rims, 34 silver ingots, large numbers of finger rings, and fragments of raw silver (see [Figure 16.12](#)). The arm rings were not used as ornaments but as a form of payment by weight. In all, the two silver hoards weighed about 148 pounds (67 kg), an immense collection of silver used in trading activities of all kinds at a time when the metal was valued by weight rather than an amount stamped on a coin. The bronze deposit weighed about 44 pounds (20 kg) and comprised mainly fragments of jewelry that originated throughout the Baltic.

Figure 16.12 Silver rings from the Spillings hoard, Gotland, Sweden, used not as ornaments but as a form of currency.

Source: Courtesy of Professor Dan Carlsson.

Viking traders dominated the Baltic trade for centuries before the rise of the Hanseatic League based on northern Germany in the twelfth century. Some captains, like the celebrated Othere, or Ottar, who visited English King Alfred's court in about A.D. 850, coasted all the way from northern Norway into the Baltic and as far east as the Vistula River. Ottar captained one of the hundreds of ships that sailed throughout Scandinavia for many centuries, their skippers acquiring great wealth,

which they took home with them. Ottar was wealthy in reindeer and ivory; others, like the islanders of Gotland, acquired silver and buried it beneath their houses, to be discovered by accident and investigated by archaeologists centuries later. Hoards like Spillings throw important light on the dynamics of long forgotten trade networks that linked remote areas of northern Europe with a far wider world.

By far the most significant of these materials is obsidian, volcanic glass that is ideal for fabricating stone tools, ornaments, and, in Mesoamerica, highly polished mirrors (see [Figure 16.13](#)). The first studies focused on the Mediterranean and southwestern Asia, where obsidian was a major trade commodity for many thousands of years.

In Mesoamerica, many scholars have attempted to trace the trade routes over which obsidian traveled from highlands to lowlands. The use of source data enables researchers to conceive of exchange on a regional basis, an approach used with success at Copán and combined with obsidian hydration dating to trace changes in obsidian trade networks over many centuries (Freter, 1993, 1994). Nowadays, the ultimate research goal is to identify the exchange mechanisms that distributed the obsidian within each exchange zone. Thus, the data requirements have changed. No longer is it sufficient to know the approximate source of a raw material or an artifact. Sources must be pinpointed accurately, and distributions of traded goods or commodities must be quantified precisely. Such data provide the groundwork for studies of trade. However, it remains to translate these distributions and the source data into characterizations of human behavior (see the Doing Archaeology box).

[Figure 16.13](#) Obsidian mirror from Mesoamerica.

Source: Courtesy of Heritage Image Partnership Ltd/Alamy Stock Photo.

Most obsidian studies have concentrated on the use of the rock and the amount of it traded from settlement to settlement. Future studies will have to monitor exchange by taking analogies from ethnohistorical and historical studies of quarrying and trade and by developing new ways of inferring behavior from the archaeological record. Chipped stone is useful in this regard, for one can reconstruct the reduction strategies used to produce traded raw material and finished artifacts

and thereby gain insights into efficiency of production and other such facets of human behavior. This approach has worked well with Paleo-Indian sites in North America, for such groups exchanged fine toolmaking stone over enormous areas or traveled long distances to obtain supplies. Ancient quarries, such as those in Greece, Mesoamerica, and Australia, are potentially valuable sources of information on the exchange of exotic materials.

Archaeologist Robin Torrence (1986) studied Aegean obsidian trade, finding that the exchange was noncommercial and noncompetitive: the prehistoric stoneworkers visited quarries and prepared material for exchange with minimal concern for economical use of the raw material. On the island of Melos, for example, the visitors simply quarried what they wanted and left. There is no evidence of specialized production. During early farming times, obsidian mining may have been a seasonal occupation, but during the Bronze Age it became a specialized occupation requiring special voyages to Melos and other quarries. The reason for the shift is unknown. Perhaps it was connected to a rising demand that outstripped the yield from seasonal visits.

Sourcing studies are sometimes called **characterization studies**, as they involve petrology and other approaches for identifying the characteristic properties of the distinctive raw materials used to fashion, say, stone axes. One should stress the word *distinctive*, for the essence of these methods is that one be able to identify the specific source with great accuracy. For example, obsidian from Lipari Island off Sicily, traded over a wide area of the central Mediterranean, has highly specific characteristics that show that it came from Lipari and nowhere else. These are but a few examples of obsidian sourcing, which is now a major specialty in archaeology. Over 50 obsidian sources are known from ancient California alone.

Isotopic chemistry has been highly effective in studying metal sources. For example, the isotopic composition of lead depends on the geological age of the ore source. Lead mines were few and far between in antiquity. Provided their location is known, it is possible to study lead sources in bronze artifacts, and also those of silver, for the latter is extracted from lead ores. This technique has been used to distinguish between Classical Greek silver coins made from mainland ore and those manufactured with metal from the Aegean island of Siphnos and other

locations.

A Unique Portrait of Ancient Trade: The Uluburun Ship

Merely studying the distribution of artifacts gives one a grossly inadequate picture of ancient trade, for such factors as the logistics of transportation, as well as local political and economic conditions, affected every aspect of trade and exchange. Few archaeological finds rival the extraordinary cargo found aboard a Bronze Age ship wrecked off the rugged Uluburun cliffs in southern Turkey. Shipwrecks offer unique opportunities to study ancient trade, for each ship on the seabed is a sealed capsule, holding a record of trading conditions at the time. George Bass and Cemal Pulak's excavation of the Uluburun ship has yielded a mine of information on the commercial world of the eastern Mediterranean in the fourteenth century B.C. (Bass et al., 1989; see the summary in Fagan, 1995). The heavily laden ship was sailing westward from the eastern Mediterranean when it was shattered on the jagged rocks of Uluburun in about 1316 B.C. (a date determined from tree rings in firewood found in the wreck). It sank in 151 feet (48 m) of water. Bass and Pulak plotted the exact position of every timber and every item of the ship's equipment and cargo as they lifted artifacts from the seabed. They recovered a unique portrait of eastern Mediterranean trade more than 3,000 years ago.

The Uluburun ship was laden with six tons of copper ingots, probably mined in Cyprus, and with tin ingots and artifacts (see [Figure 1.7](#) on page 15). The tin may have come from southern Turkey. Canaanite jars from Palestine or Syria held olives, glass beads, and resin from the terebinth tree, used in religious rituals. The ship's hold contained Baltic amber that probably reached the Mediterranean overland, ebony-like wood from Africa, elephant and hippopotamus ivory, and ostrich eggshells from North Africa or Syria. Egyptian, Levantine, and Mycenaean daggers, swords, spearheads, and woodworking tools were aboard, as were sets of weights, some fashioned in animal forms. There were costly glass ingots, Mesopotamian cylinder seals, a Mycenaean seal stone, even a gold cup and parts of a tortoiseshell lute. The ship carried Egyptian scarabs, dozens of fishing weights, fishhooks, and 23 stone anchors, vital when

anchoring in windy coves. Even the thorny burnet shrub used to pack the cargo was preserved. One unique find was a diptych, a wooden cover for a wax tablet used to record commercial transactions.

Doing Archeology Sourcing Obsidian and Basalt

Scientists studied the sources of toolmaking stone long before the advent of spectrographic analysis, relying both on petrology and on distinctive rocks, such as the butter-colored and easily recognized Grand Pressigny flint, widely used in France by Stone Age farmers. High-tech analytical methods have revolutionized sourcing since the 1960s, when British archaeologist Colin Renfrew and others used spectrographic analysis to identify no fewer than twelve early farming villages that had obtained obsidian from the Ciftlik area of central Turkey. (See [Figure 16.14](#).) This pioneer study showed that 80 percent of the chipped stone in villages within 186 miles (300 km) of Ciftlik was obsidian. Outside this “supply zone,” the percentages of obsidian dropped away sharply with distance, to 5 percent in a Syrian village and 0.1 percent in the Jordan Valley. If these calculations were correct, each village was passing about half its imported obsidian farther down the line. Renfrew and his colleagues identified no fewer than nine obsidian “interaction zones” between Sardinia and Mesopotamia, each of them linked to well-defined sources of supply, each yielding obsidian with its own distinctive trace elements identifiable spectrographically.

Geochemical sourcing has yielded rich dividends in Polynesia, where we now know that fine-grained basalt from the Eiao quarry in the northern Marquesas traveled in canoes to Mangareva Island, 1,087 miles (1,750 km) to the south-southwest and to the remote Line Islands, some 1,491 miles (2,400 km) northwest, as well as to the Tuamotus and Society Islands. This huge interaction sphere spanned some 2,485 miles (4,000 km) from end to end. How sporadic the trade in finished axes was remains an open question (Weisler, 2008).

Figure 16.14 Obsidian trade in the eastern Mediterranean region. Sourcing studies reveal that early farming communities in Cyprus, Anatolia, and the Levant obtained their obsidian from two sources in central Anatolia. Meanwhile, villages such as Jarmo in the Zagros Mountains and Ali Kosh far to the southeast relied on sources in Armenia. Settlements like Çatalhöyük in

Anatolia were so close to obsidian sources that they probably collected their own supplies. More than 80 percent of their stone artifacts are made of the material, whereas obsidian tools are much rarer down the line, the farther one travels from the source.

By using find distributions from land sites and a variety of sourcing techniques, Bass and Pulak have reconstructed the anonymous skipper's last journey. They believe he started his voyage on the Levant coast, sailed north up the coast, crossed to Cyprus, then coasted along the southern Turkish shore. The ship called at ports large and small on its way west, along a well-traveled route that took advantage of changing seasonal winds, to Crete, some Aegean islands, and perhaps to the Greek mainland. The skipper had traversed this route many times, but on this occasion his luck ran out and he lost his ship, the cargo, and perhaps his life on Uluburun's pitiless rocks. From the archaeological perspective, the Uluburun shipwreck is a godsend, for it allows researchers to fill in many details of an elaborate trade network that linked the eastern Mediterranean with Egypt, the Aegean, and Greece more than 3,300 years ago. Bass and Pulak suspect that the Uluburun ship may have been carrying an unusually valuable cargo, but the owners remain a mystery.

The Uluburun ship carried what was an exceptionally rich cargo, perhaps for some monarch. This dramatic find illuminates the remarkable, and often unsuspected, degree of interconnection between even quite distant peoples in ancient times. Thanks to modern science, we can trace its fatal voyage and its cargo with considerable accuracy.

Summary

1. A new generation of archaeological research is turning away from impersonal cultural processes toward the study of people and small groups. Such research marries modern archaeological data recovery methods with new interpretative approaches that consider the archaeologist an "active media-tor" of the archaeological record of the past.
2. Discoveries of actual individuals from the past, such as the Ice Man in the European Alps, allow us to make detailed studies of

the health, diet, and activities of individual people.

3. Biological anthropology/archaeology uses human skeletal remains and DNA to study ancient population movements, paleopathologies, wounds, and other data about humans in the past.
4. Social ranking is difficult to study from archaeological evidence. It can be studied in the archaeological record by using burials and associated grave furniture, as at Ur in Mesopotamia, and by using structures or artifact patterns.
5. The archaeology of gender is assuming increasing importance as a means of identifying changing male/female roles in the past and of studying individuals in prehistory. These researches involve detailed studies of grave furniture; studies of female pathology, which reflect such activities as constant grain grinding; and extrapolations of material data into hypothetical scenarios of changing gender relations. The latest research is also forcing us to question if some of our basic cultural assumptions that simple male/female distinctions are—or ever were—valid.
6. Ethnicity and social inequality have been studied by archaeologists working with African American sites and other sites in North America. Such researches involve identifying distinctive artifacts that reflect African religious beliefs and material signs of silent resistance to the dominant culture.
7. Trade and exchange were important means of human interaction from the earliest times. Much early trade probably took the form of gift exchanges and the bartering of food and other commodities between neighboring settlements. Trade is normally recognized in the archaeological record by the discovery of exotic objects far from their places of origin. Prehistoric trade networks are studied by examining the distributions of such objects and the sources of raw materials used to make artifacts. One example is the Uluburun shipwreck off southern Turkey, which revealed the complexity of eastern Mediterranean trading in the fourteenth century B.C.

Further Reading

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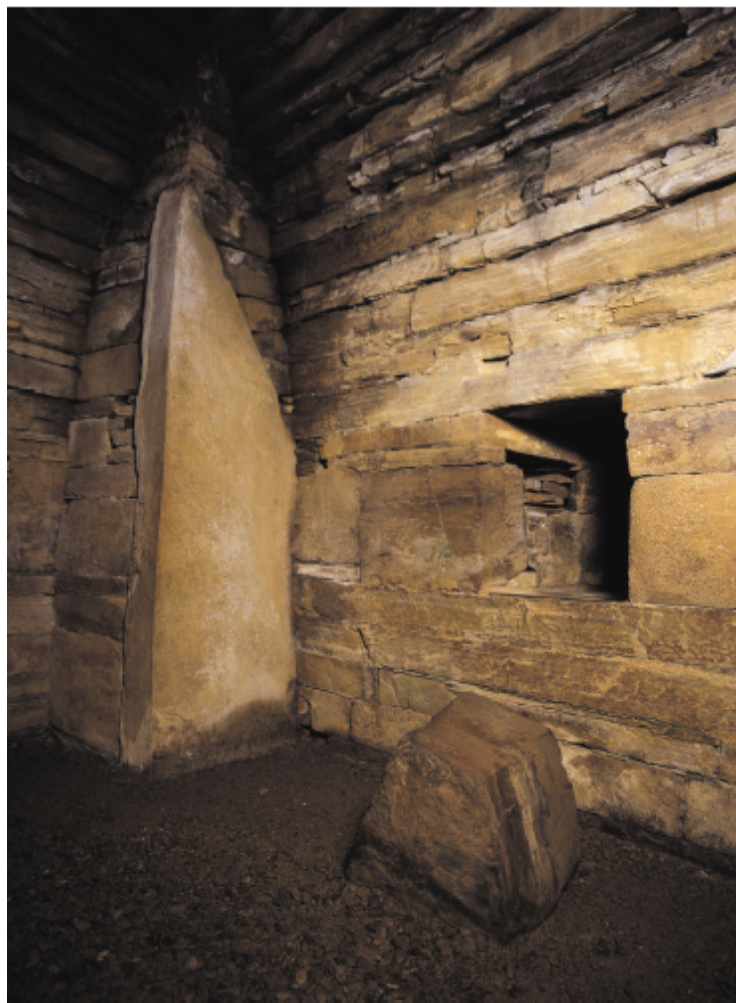


















17

Archaeology and the Intangible

CHAPTER OUTLINE

A Framework of Common Belief

Cognitive Archaeology

Ethnographic Analogy and Rock Art

The Archaeology of Death

Artifacts: The Importance of Context

Artifacts and Art Styles

Sacred Places

Astroarchaeology and Stonehenge

Southwestern Astronomy and Chaco Canyon

A Maya noblewoman dressed like a queen in rich textiles, wearing a bloodletting crown.

Source: © Justin Kerr.

Whenever we visit the great city of Teotihuacán in Mexico, we're haunted by the past. We look down from the summit of the Pyramid of the Sun at the tiny human figures dwarfed by the massive artificial mountain and wonder at the scale of a city built by thousands of people working in the service of divine lords and powerful gods. We stand in the plaza at the foot of the pyramid and sense the overwhelming weight of power and supernatural might that the builders wished to convey. Teotihuacán is a powerful statement, but so much is lost. The pyramid was once the setting for dazzling spectacles, a stage where masked lords appeared in trance, where brilliantly colored dancers performed, where chants and incense rose into the evening sky. The colors have long since faded. No banners fly over temples; the stories told by narrators and priests have vanished on the wind. Teotihuacán is now an empty stage, devoid of the transparent things through which the cosmos once came to life. All that is left are the material remains of the spiritual and the sacred—mirrors of the intangible (see [Figure 15.14](#) on page 301). This chapter describes how archaeologists wrestle with the toughest problem of all: reconstructing the intangible religious beliefs, ideologies, and social relationships of the past.

A Framework of Common Belief

We are *Homo sapiens*. We are capable of subtlety, of passing on knowledge and ideas through the medium of language. We have consciousness and self-awareness and are capable of foresight. We can express ourselves and show emotions.

Archaeology has traced *H. sapiens* back to Africa over 300,000 years ago, with the first fully **anatomically modern humans (AMHs)** appearing around 120,000 years ago. We know that our AMH forbears had settled in western Asia by 95,000 years ago, and in western Europe by 45,000 years before the present. It is with the AMHs that we find

ever-increasing amounts of archaeological evidence for symbolic expression and spiritual thought—for defining the boundaries of existence, and for conceptualizing the relationship between the individual, the group, and the cosmos.

It used to be said that this creativity appeared suddenly—as a sort of modern human cerebral/cultural Big Bang around 40,000 years ago (Mithen, 1996). However, archaeologists are now finding increasing evidence for symbolic thought long before 40,000 years ago. For example, the team working at the Blombos Cave in South Africa, a long-term occupation site of AMHs, discovered decorative including perforated seashells and 41 perforated tick shells dated to around 75,000 years ago (Henshilwood et al., 2004). The shells were probably strung together in a necklace and suggest a modern way of thinking and behaving. In even earlier levels at Blombos, dating to c. 100,000 years ago, the team also found possible paint pots and other potential art supplies (Henshilwood et al., 2011). Of course, the Blombos “paint” may have had other uses including hafting, skin protection against insects, or medicine, but it still opens up the possibility that early AMHs were making art, and therefore capable of symbolic thought, far earlier than once imagined.

However, we were not alone in our creativity. An engraved shell from Java, dated to about 500,000 years ago, is thought to be the work of *Homo erectus* (Callaway, 2014). Though more a “doodle” than “art” per se, it still makes us question the old assumption that modern humans were the only symbolic thinkers. Indeed, there are suggestions that *Homo heidelbergensis*—potentially linked to the last common ancestor of the Neanderthals and us—also possessed symbolic capacities around 300,000–400,000 years ago (D’Errico, 2003). Likewise, there is fleeting evidence for symbolic behavior among the Neanderthals, such as the eight polished eagle talons dated to 130,000 B.C., which might represent possible ornamentation, found at the Neanderthal site of Krapina in Croatia (Radović et al., 2015). Nonetheless, it is fair to argue that the archaeological record for hominin creativity really takes off with AMHs, with some of the most spectacular and famous examples of prehistoric art coming from the late Ice Age of Europe (Bahn, 2016). Such rock art suggests that the artists lived in a highly spiritual world.

Spiritual or religious beliefs have often linked large areas of the

world into gigantic spheres of a common **cosmology** (a view of the world and the universe) and ritual practices, even if the many peoples unified under a common religious banner enjoy widely disparate governmental, societal, and economic institutions. Thousands of ancient societies were linked by common beliefs and cosmologies, which are reflected in the archaeological record by common artistic traditions, temple and ceremonial-center architecture, wall paintings, and even trade in cult objects. For example, in the American Midwest the Hopewell religious cult, with its preoccupation with ceremonial burial, spread far beyond its Ohio heartland (Fagan, 2011). And in southern Africa, the ceremonial centers at Mapungubwe and Great Zimbabwe are associated with the rainmaking beliefs and ancestor cults of the Shona peoples (Connah, 2001).

By 10,000 years ago, when the first farming societies appeared in western Asia, the various cosmologies began to share several common elements, which are often reflected in archaeological evidence (Fagan, 1998). First, the world of living humans formed part of a multilayered cosmos, sometimes comprising primordial waters, with the heavens and an underworld. Gods, goddesses, spirit beings, and ancestors inhabited the supernatural layers of the cosmos. This universe often began as a dark sea of primordial waters, or, as the book of Genesis puts it, a world “without form.”

Second, a vertical axis, often a symbolic tree, or support for the bowl of heaven, linked the various cosmic layers. Mircea Eliade (1954), one of the great religious historians of the twentieth century, stressed the importance of this *axis mundi* (axis of the world), which joined the living and spiritual worlds at a mythic center, a sacred place—either a natural feature, such as a cave or a mountain, or a human-made structure such as a pyramid.

Such sacred places, and the mythic landscapes associated with them, played a vital role in all societies. Eliade (1954) called them “instruments of orthogenetic transformation,” settings for the rituals that ensured the continuity of cultural traditions, a place where the word of the gods rang out in familiar chants passed from one generation to the next. Sacred mountains such as the Hindu Mount Meru, the Greeks’ Olympus, or the Lakota Indians’ Black Hills often served as the cosmic axis. The Egyptian pharaohs erected pyramids as

sacred mountains linking the domain of the sun to the realm of the earth (see [Figure 16.7](#) on page 323). Maya lords built great ceremonial centers as symbolic representations of their world of sacred mountains, caves, trees, and lakes (see [Figure 15.3](#) on page 291). To demolish a sacred place was to destroy the essence of human existence itself. In 1521, Spanish conquistador Hernán Cortés razed the Aztec capital Tenochtitlán in the Valley of Mexico, knowing that its temples and plazas replicated a cherished and all-encompassing supernatural world (see [Figure 15.4](#) on page 292).

Third, the material and spiritual worlds formed a continuum, with no boundary between them. An “external” landscape on the earth was also an “internal” landscape of the mind, or “landscape of memory,” where colors, jagged peaks, streams, groves of trees, cardinal directions, and other phenomena had spiritual associations and their places in local mythology. Usually, ancestors, those who had gone before, were the intermediaries between the living and the supernatural worlds. They looked after the welfare of the living and were guardians of the land

Fourth, individuals with unusual supernatural powers, either **shamans** or spirit mediums, had the ability to pass effortlessly in an altered state of consciousness between the material and spiritual realms, to fly free in the supernatural world through ritual and performance (Sullivan, 1989). Such men and women “of power” had direct and personal links to the supernatural world. Shamans moved easily into the spiritual world. There they “dreamt,” going through visionary experiences in which they saw dots, lines, spirit animals, and even gods and ancestors. From their dream journeys, they acquired the wisdom to keep their world in balance with the sacred and the power to influence events in the natural world. They were healers; they brought rain; they became sorcerers who could bring disease or cause factional strife or even war. The shaman was a spiritual actor who functioned as an intermediary to the ancestors and the spiritual world.

Last, human life was governed by the cycles of the seasons, by seasons of planting, growth, and harvest, identified by movements of the heavenly bodies. Notions of fertility, procreation, life, and death lay at the core of such a cyclical human existence. Myth and ritual played an important part in defining this world order. They allowed the material and spiritual worlds to pass one into the other as a single

constellation of belief. Through poetry, music, dance, and evocative surroundings, a deep sense of a sacred order emerged.

The intangible assumed many forms, but these commonalities, observed by anthropologists and religious historians in many human societies throughout the world, provide a viable framework for scientific investigation of ancient sacred places, the settings for mythic performance. The stone circles at Avebury and Stonehenge in Britain, the courts of the Palace of Knossos on Crete, and Maya pyramids—all tell us much of long-vanished religious beliefs (see Discovery box).

Cognitive Archaeology

A couple of generations ago, a small group of archaeologists challenged their colleagues to move beyond artifacts and food remains. They asked: Why should we interpret the past in terms of purely ecological, technological, and other material factors? Some of the best minds in archaeology began to grapple with a scientific methodology for studying human consciousness, especially religion and belief.

From an archaeological perspective, the term **cognitive archaeology** covers the whole spectrum of human behavior, especially religion and belief, but also the development and expression of human consciousness (Renfrew and Scarre, 1998). Since the very early days of archaeology, researchers have been concerned with ancient religion, belief, and expression, the subject matter of cognitive archaeology, sometimes called the archaeology of mind. How can we define cognitive archaeology? Is it possible to study human cognition from the material remains of the archaeological record, even if we cannot afford to ignore it? As discussed in [Chapter 3](#), a cognitive-processual approach draws on both old and new models and methods to try to assess ancient belief systems.

DISCOVERY The Sepulcher of the Maya Lord Pacal, Palenque, Mexico, 1949

Palenque is a Maya city, famous for its architecture and for a long dynasty of talented lords, starting with Chan-Bahlum (Snake-Jaguar), who ascended to the throne on March 11, A.D. 431. The dynasty

flourished for just under 400 years, achieving the height of its power under the rule of Pacal (Shield) and his son in the seventh century. Pacal ruled for 63 years and turned Palenque into a major political force in the Maya lowlands. When he died, he was buried in an underground sepulcher beneath a pyramid and the celebrated Temple of the Inscriptions, built over 15 years.

In 1949, Mexican archaeologist Alberto Ruz, convinced that a royal tomb lay beneath the pyramid, lifted a flagstone in the floor of the temple and cleared a rubble-filled stairway leading into the heart of the artificial mountain (Ruz, 1953). Five months of backbreaking work over two seasons cleared a stairway with 45 steps, then a sharp U-turn, which led to another short 21-step stairway and a corridor at the same level as the foot of the pyramid. After removing a stone and lime obstruction, Ruz came to a triangular doorway slab, guarded by six young sacrificial victims. He moved the stone enough to slip into an enormous rock-cut crypt with a procession of priests in stucco around the walls. A huge stone slab bearing intricate hieroglyphs filled the floor of the chamber (see [Figure 17.1](#)).

To lift the 5-ton stone, Ruz's workers felled a hardwood tree, lowered four sections of the trunk down the stairway, then levered up the sarcophagus lid with car jacks and the timbers. Inside the sepulcher lay a tall man wearing jade and mother-of-pearl ornaments. He wore a jade mosaic mask with eyes of shell, each iris of obsidian. At the time of the excavation, no one could read Maya glyphs, so the identity of the ruler remained unknown. We now know it was Pacal. His carved sarcophagus lid commemorates his divine ancestry.

Figure 17.1 Reconstruction of royal tomb, Temple of the Inscriptions, Palenque, Mexico (Maya city that flourished circa A.D. 600–750, Late Classic era).

Source: Courtesy of DeAgostini/Getty Images.

One of the aims of recent research in cognitive archaeology has been to make mainstream archaeology more holistic. For example, Kent Flannery and Joyce Marcus (1993a) have attempted to understand ancient Zapotec subsistence behavior in Mexico's Valley of Oaxaca by taking into account early Spanish descriptions of local Native American cosmology. Flannery and Marcus consider cognitive archaeology to be

“the study of all those aspects of ancient culture that are the product of the ancient mind.” This includes cosmology, religion, ideology, iconography, and all forms of human intellectual and symbolic behavior.

In the Valley of Oaxaca, many village farming communities functioned without any apparent ranking between 1400 and 1150 B.C. Between 1150 and 850 B.C. , the first artistic depictions of supernatural lineage ancestors appear: Some represent the earth; others represent the sky in the form of lightning or a fire serpent. Some form of hereditary social ranking seems to accompany the new art. Then the Zapotec state came into being, with a powerful elite ruling from Monte Alban. A tiny minority became associated with depictions of sky and lightning, while earth and earthquake symbols faded into obscurity. It was as if those who rose to prominence were associated with lightning’s descendants, in an ideological shift in which hereditary social inequality was condoned for the first time.

All cultures have a theory of the universe in which they live. Their cosmology, like that of Western civilization, constitutes a theory of the origin of the universe, defines space and time, and can provide a structure for religion and ideology. Many cultures, among them ancient Greek and Maya, envisage a cosmos inhabited by supernatural beings, another link to religious beliefs. Although cosmology can have a strong influence on both settlement and subsistence, as, for example, in cases where certain aspects of the environment, such as pristine forest, may be held sacred, it is difficult, if not impossible, to reconstruct cosmology from animal and plant remains alone.

Religious beliefs provide ethics and values, often within the framework of a quest for the values of an ideal life. A well-defined worldview links cosmology and religion, the latter providing the rituals and practices that help the worshiper attain the ideal. Clearly, ethics and values can have a powerful effect on human behavior, even on such pragmatic areas of life as obtaining food and trading. Religion can be a powerful catalyst for social and political change, as was the case, for example, when Buddhist merchants brought their religion to southeastern Asia and changed the course of history by providing the spiritual inspiration for a series of brilliant kingdoms, such as those of the Khmer (Wheatley, 1975).

Any archaeologist concerned with the appearance of ranked, as opposed to egalitarian, societies is studying fundamental changes in ideology, simply because egalitarian societies tend to have leveling mechanisms that prevent one individual or group from attaining superior rank. Again, these changes can only be documented through judicious use of historical analogies and artifacts.

Cognitive archaeology is no shortcut, but an approach to cosmology, religion, ideology, and iconography based on rigorous analysis and data from many sources. It is a theoretical perspective that offers enormous promise for the future, but it falls far short of reconstructing entire ideologies from the orientation of a building or a single carving.

Renfrew (1993) considered the challenge for cognitive archaeology to be establishing a coherent methodology. This methodology may emerge from the convergence of such diverse fields as cognitive psychology, artificial intelligence, computer simulation, and cognitive archaeology itself. But this convergence, and the potential intellectual leap forward that might result, will not depend on rigorous research methods. Thus, it can be used only when the body of supporting data is rich. Otherwise, it becomes “little more than speculation, a kind of bungee jump into the Land of Fantasy” (Flannery and Marcus, 1993b: 110).

In practical terms, and for obvious reasons, cognitive archaeology is usually most effective when historical records are available to amplify the archaeological record, as they are when working with archaeological evidence and Maya inscriptions (Schele and Freidel, 1990). Flannery and Marcus (1993b) believe that one approach to reconstructing ancient religions is to construct models from ethnohistoric sources, then to isolate temples, artifacts, art styles, and other cultural elements that can be identified archaeologically. These features are studied in their cultural context, and the observed archaeological remains are compared with the model from ethnohistoric documents.

Iconography—the “analysis of the way ancient peoples represented religious, political, ideological, or cosmological objects or concepts in their art” (Flannery and Marcus, 1993b)—offers a fertile avenue for cognitive archaeology. Again, ethnohistory and history provide vital background for the interpretation of the archaeological record, for without such information one is engaged in little more than guesswork.

Such studies, based very often on intuition and “aesthetic sense,” reflect the author’s personality more than reality.

Cognitive archaeology reaches a high degree of refinement when document-aided, as is the case with the Aztec civilization of Mexico or the Inca of the Andes. But earlier societies—for instance, the first farming societies of southwestern Asia, with their female figures and plastered human skulls—offer greater challenges. It is all too easy to call each female figure a “fertility figurine” and to talk of ancient mother goddesses, when there is, in fact, no scientific basis for such conclusions.

Ethnographic Analogy and Rock Art

The late Ice Age rock paintings of southwestern France and northern Spain are justly famous for their brilliant depictions of long-extinct game animals, painted between 15,000 and 30,000 years ago (Bahn and Vertut, 1998). For generations, scholars have grappled with the meaning of the paintings, for they realized long ago that they were far more than merely art for art’s sake. In an era where new technology means, for example, more nuanced dating methods, we can reasonably hope that we can achieve a greater understanding of the meaning of the art in the future. This greater comprehension result, in part, from some of the dating work being undertaken at Chauvet (see the Doing Archaeology box on page 347).

Moving across continents, the rock paintings by Stone Age artists in southern Africa are also justly famous, but they are very different from those of late Ice Age Europe. Whereas most rock paintings and engravings in Europe depict animals, human hands, and numerous signs, the art in southern Africa commemorates not only animals but also scenes of the hunt, women gathering, people in camp, and elaborate ceremonies (see [Figure 13.13](#) on page 263). Until recently, we had no idea of the meaning of these paintings, until archaeologist David Lewis-Williams (1981) came across the long-forgotten research notebooks of a German linguist named Wilhelm Bleek. Bleek made a lifetime’s study of African languages. In 1870, he discovered that there were 28 San convicts working on the breakwaters of Cape Town harbor; he arranged for them to be released into his supervision and

used them as informants. Bleek and his sister-in-law Lucy Lloyd recorded an enormous body of San mythology and folklore over nearly 20 years. Their work lay neglected in the University of Cape Town Library until Lewis-Williams discovered them in the 1970s.

The Bleek archive contains numerous accounts of rainmaking and other rituals recounted by men who had practiced the rituals themselves. Bleek himself was familiar with a few rock paintings. His informants were able to explain scenes of men charming a mythic rain-making animal with sweet-smelling grasses.

Lewis-Williams realized that the paintings were the result of thought patterns that reflected shared beliefs and behavior over large areas where paintings were to be found. He talked to living !Kung San in the Kalahari Desert and showed them pictures of paintings. His informants were able to identify antelope of different sexes and groupings of them painted at different times of the year. Lewis-Williams became particularly interested in the eland, a large, fat antelope that is so slow on its feet that a hunter can run it down on foot. A single eland can feed a small band for days, so they assumed great importance in environments where food supplies could be irregular. Bleek's informants had recited myths that associated the scent of recently killed eland with honey.

Lewis-Williams has examined hundreds of eland paintings in the Drakensberg Mountains and elsewhere, including scenes of eland staggering in their death throes as dancers cavort around the animal. White dots depict the sweat dripping from a dancer who is "dying" in trance. Lewis-Williams believes that these dancers were acquiring the potency released by the death of the eland, a process shown by the antelope heads, feet, and hair on the dancers. He realized that painting after painting linked society with the supernatural, the medium responsible for this linking being a shaman, who induced a trance by intense concentration, prolonged rhythmic dancing, and hyperventilation. Today, the !Kung San still dance next to the carcass of a freshly killed eland as a shaman enters trance. A word of caution, however—these ideas can provide only general clues since modern/historical !Kung San art cannot be used to definitively interpret the traditions of 20,000 years ago. Moreover, various researchers are now questioning the shamanistic interpretation of rock art, historical San or

otherwise.

Figure 17.2 San rock art from South Africa showing dancers, perhaps shamans dancing in a trance around an eland. To some interpreters, their elongated bodies convey the sense of being stretched out, as if felt by people in an altered state of consciousness.

Source: Courtesy of Album/Alamy Stock Photo.

Doing Archaeology The Art of the Grotte de Chauvet, France

The Chauvet-Pont-d'Arc Cave, in the Ardeche region of southern France, is a series of painted and engraved chambers. Eliette Brunel Deschamps, Jean-Marie Chauvet, and Christian Hillaire, crawled into a small opening in the Cirque d'Estre gorge of the Ardèche in southeastern France. They descended into a network of chambers adorned with superb calcite columns. Calcified cave-bear bones and teeth lay on the floor, and they noticed shallow depressions where the beasts had hibernated. The group soon penetrated into the main chamber and came upon numerous paintings: hand imprints and figures of mammoths, wild oxen, and cave lions (see [Figure 17.3](#)). As they gazed at the paintings, the three explorers were “seized by a strange feeling. Everything was so beautiful, so fresh, almost too much so. Time was abolished, as if the tens of thousands of years that separated us from the producers of these paintings no longer existed” (Chauvet et al., 1996: 42). Like the excavators of the tomb of the Egyptian pharaoh Tutankhamun three-quarters of a century before, they felt like intruders: “The artists’ souls and spirits surrounded us. We thought we could feel their presence” (page 42).

More than 400 images adorn the walls, including a dynamic frieze of black horses, bison with twisted horns, and two rhinoceroses in combat. There are horses, lions, stags, and engravings of an owl, covering an area of more than 30 feet (10 m). A little deeper into the chamber lies a slab that had fallen from the ceiling in ancient times. A bear skull is set upon it and the remains of a small fire lie behind it. Over 30 calcite-covered bear skulls surround the slab. A 30-foot (10 m) frieze of black figures dominated by lions or lionesses, rhinoceros, bison, and

mammoth lies in an end chamber, a human figure with a bison head standing to its right. When the speleologists first came upon the figure they wrote that it “seemed to us a sorcerer supervising this immense frieze” (Chauvet et al., 1996: 110).

The ancient artists were superb illustrators and masters of perspective. At times, they overlapped the heads of animals to create movement, or scraped the walls before painting, so causing the figures to stand out. On other occasions, they used their hands to spread out the paint in ways that created dimension and color tonality.

Figure 17.3 A reproduction of an Ice Age image from the Chauvet-Pont-d’Arc Cave, showing woolly rhinos, aurochs, and horses.

Source: Courtesy of www.BibleLandPictures.com/Alamy Stock Photo.

The meaning of Ice Age art to its people has long been debated. Was it art for art’s sake, was it a teaching tool, religious expression, or something else? The fact that the cave was a place where bears came to hibernate, has informed some of the interpretations—as has the observation that many of the illustrated animals are dangerous beasts: bears, lions, mammoths, rhinos, bison, and the nimble yet ferocious aurochs (wild oxen). Perhaps humans came to the chambers to acquire the potency of such animals, perhaps particularly the bears, whose scents might have lingered in the darkness.

Context is everything in archaeology, and the date of the art is vital to its interpretation, and indeed the wider understanding our human story. And yet, it is devilishly hard to reliably date rock art. Accelerator mass spectrometry (AMS) radiocarbon dates from two rhinoceroses and a large bison have pointed to a 1,300-year period around 32,000 B.P., which would make these elaborate paintings the earliest-known complex art in the world. Two more dates from torch smears on the walls are put at around 26,500 B.P. , while two charcoal samples on the floor gave readings of about 24,500 B.P. , suggesting that humans visited Chauvet on several occasions over at least 6,000 or 7,000 years.

If the art is truly Aurignacian (c. 35,000–28,000 B.P.) then it means art emerged suddenly and technically fully developed (which fits nicely with the cerebral/cultural “Big Bang” theory, in which humans “suddenly” became creative, and fully mentally “modern”). Yet a

number of researchers, including Pettitt and Bahn (2015), argue that these very early dates are unreliable. Many times, the dates are simply linked to unrelated firing episodes and not to the art itself, and therefore need to be rejected. Moreover, if one looks at the art from a purely stylistic perspective, the rest of the known Aurignacian art corpus is made up of technically simple outline paintings and engravings. By contrast, as Pettitt and Bahn (2015) point out, the style of the Chauvet art is much more in keeping with the later (post 20,000 B.P.) artistic traditions. It is hoped that more nuanced dating methods, such as the Uranium-Thorium method (which dates stalactites over the art to produce minimum ages) will reveal more (Pike, 2019). Research continues apace, and debate is often heated, so watch this space.

The Archaeology of Death

The Maya lord Pacal ruled over the city of Palenque and its surrounding domains from A.D. 615 for no less than 67 years. He turned Palenque into a major political force in the Maya lowlands by political marriages, diplomatic offensives, trade, and conquest (Schele and Freidel, 1990; see the Discovery box on page 344). Pacal erected the Temple of the Inscriptions as his burial place, one of the masterpieces of Maya architecture. The builders dug a large burial chamber with an immense sarcophagus below ground, then erected the temple pyramid atop it. A secret internal stairway led to the sanctuary of the temple on the summit of the sacred mountain. Mexican archaeologist Alberto Ruz probed under the temple floor, cleared the stairway of rubble, and found Pacal under a richly carved sarcophagus lid that depicted his sacred genealogy. The great ruler wore a magnificent jade mask; his hair was adorned with jade tubes; elaborate ornaments masked his body; and all the grave furniture reflected his status as a powerful personage with supernatural powers.

The symbolism of death and burial is an important source of information on ancient religious beliefs as well as social ranking, most notably in the regalia and artifacts deposited with the deceased (Gowland and Knusel, 2009). For Egyptian pharaohs, the actual disposal of the corpse was really a minimal part of the sequence of mortuary practice in a society. Funerary rites were a ritual of passage and were

usually reflected not only in the position of the body in the grave but also in the ornaments and grave furniture that accompanied it (Clayton, 1994). For instance, the Egyptian pharaoh Khufu expended vast resources on building his pyramid and mortuary temple at Giza in 2550 B.C. (Lehner, 2008). (See [Figure 16.7](#) on page 323.) The royal tomb was looted within a few centuries, but the pyramid shape endures, a powerful statement of Egyptian kingship. Egyptian pharaohs were considered to be the living embodiment of the Sun God Ra and joined him in the skies at their death. The pyramids were symbolic sun rays, like the sun bursting through clouds overhead, a type of ladder to heaven for their owner.

Some Native American groups, notably the Hopewell people of eastern North America, buried magnificent ceremonial artifacts with prominent individuals. Such artifacts as soapstone pipes, copper sheet portraits, and masks reflected not only the status of the owners but also their clan affiliation and importance as shamans or priests (Fagan, 2019).

Artifacts: The Importance of Context

In 1953, British archaeologist Kathleen Kenyon unearthed a cache of human skulls covered with plaster in a pit under a house floor at Jericho in the Jordan Valley. Each head was a naturalistic, individual portrait, with nose, mouth, and ears modeled with remarkable delicacy onto the skull ([Figure 17.4](#)). Apparently, they were portraits of ancestors. The cowrie-shell eyes of the others glare unblinkingly at the beholder, giving an impression of inner wisdom. We will never know what ritual surrounded these ancestor portraits, but their context, buried under a hut floor, speaks volumes about the close relationship between living households and their ancestors. Plastered human skulls, like other art objects and tools of all kinds, can give us insights into ancient beliefs. Very often, their contexts within sites are as important as the objects themselves.

[Figure 17.4](#) Plastered human skull from Jericho, Jordan, believed to be a portrait of an ancestor, circa 9000 B.C.

Source: Courtesy of Kent V. Flannery, University of Michigan.

Clay figurines are commonplace in eastern Mediterranean sites. Some may depict goddesses. Others may be little more than trade tokens or children's toys. Often their religious associations are controversial.

Despite the figurine controversy, the occurrence of distinctive artifacts and ritual buildings in a site or a society may be significant. In Mexico's Valley of Oaxaca, public buildings appear between 1400 and 1150 B.C. , many of them oriented 8 degrees west of north and built on adobe and earth platforms (Flannery, 1976). Rare conch-shell trumpets and turtle-shell drums traded from the coastal lowlands were seemingly used in public ceremonies in such buildings. Clay figurines of dancers wearing costumes and masks that make them look like fantastic creatures and animals, as well as pottery masks, are also signs of communal ritual (see [Figure 17.5](#)). The ritual of self-mutilation by bloodletting was widespread in early Mesoamerica. The Spanish described how the Aztec nobles would gash themselves with knives or with fish and stingray spines as acts of penance before the gods, imposed by religion. A few stingray spines have come from early Oaxacan villages, probably traded into the far interior for the specific use of community leaders. Flannery suggests that bloodletting fish spines were kept and used at home and that they were also used in public buildings. The ritual artifacts in the Oaxacan villages enabled Flannery and his colleagues to identify three levels of religious ceremony: personal bloodletting; dances run by kin groups, which cut across household lines; and public rituals in ceremonial buildings, involving a region wider than one village (see the Site box).

SiTE: The Shrine at Phylakopi, Melos, Greece <

The small Mycenaean town of Phylakopi on the island of Melos in the Aegean Sea was home to an estimated 1,400–2,100 people between 1390 and 1090 B.C. The settlement was a maze of small stone houses, narrow alleyways, and courtyards, excavated by Colin Renfrew using a 33-foot (10 m) grid that allowed him to record architectural changes and stratigraphy with great precision. This excavation method, combined with meticulous studies of the Mycenaean pottery, provided very precise contexts for the finds and enabled Renfrew to identify an important shrine in the town (Renfrew, 1985).

He first suspected a shrine when he recovered broken animal and human figurines in his trenches. Slow-moving excavation over the floors of the putative shrine rooms revealed stone platforms and exotic objects, such as seal stones. But the evidence for religious activity was modest at best until the excavators uncovered a side chamber and a wall niche in the westernmost shrine room. This contained a pedestaled vase, fragments of an ox-like figure, other figurines, and a remarkable female figurine that stood upright in the room. “The Lady of Phylakopi,” as Renfrew named her, had a conical stem painted like a long skirt, a bulbous body with small breasts, a painted brown chin, staring eyes, and eyebrows and hair outlined in brown. Another female figurine stood to one side.

The figurines could have come from a storeroom, so Renfrew studied the design of the chambers. He found that the builders had laid them out in such a way that the symmetrically placed platforms were the focus of attention.

The objects displayed on them would have caught attention at once. And the “shrines” yielded conch-shell trumpets that were identical to those blown by priestesses on seals from Crete. Perforated tortoiseshell fragments were the remains of lyre bodies. The fine pottery that was found inside the two shrines was of much better quality than that found elsewhere on the site.

The precise contexts of these finds allowed Renfrew to conclude that he had found the town shrine, which is duplicated, at least superficially, at other sites on Crete and the Greek mainland.

Figure 17.5 Excavations on Melos.

Source: Courtesy of Terry Harris/Alamy Stock Photo.

Artifacts and Art Styles

Ideology is a product of society and politics. It is a body of doctrine, myth, and symbolism associated with a social movement, an institution, class, or group of individuals, often with reference to some political or cultural plan, along with the strategies for putting the doctrine into operation.

Writing is power, especially in societies where only a tiny proportion

of the population is literate. For most people, knowledge of all kinds—hunting expertise, farming know-how, weaving skills, and religious beliefs—passed from one generation to the next by word of mouth, through chants, rituals, and many other means. Art and architecture are powerful ways of propagating religious beliefs and ideologies, especially in highly centralized societies where the entire fabric of society depends on social conformity.

Strong ideologies drove all preindustrial civilizations. The Egyptian pharaohs were seen as living personifications of the Sun God Ra. Maya lords had divine ancestry and unique abilities to intercede with the supernatural world. The supreme Inca ruler epitomized the sun. The ideologies that reinforced these beliefs surrounded everyone; they were depicted with familiar motifs on textiles and pottery, on temple walls, and in carvings. Artifacts and buildings were often expressions of widely held religious beliefs.

Figure 17.6 Olmec head.

Source: Courtesy of Shutterstock.

Such ideologies come down to us in highly attenuated form. We see them in the snarling faces on Olmec portrait heads (see [Figure 17.6](#)), axes, and altars from lowland Mesoamerica, where lords and jaguars had close associations and where human shamans transformed themselves in trance into fierce beasts. We see them on the fine copper portraits of rulers and animals crafted by Hopewell artisans and buried with prominent individuals over 2,000 years ago. Mississippian art motifs preserved on shell ornaments, pots, and other artifacts reflect religious beliefs that have survived, in modified form, into historic times. Decoding such messages is extremely difficult, especially when there are no ethnographic or historical accounts to guide the researcher.

The Moche state on the north coast of Peru enjoyed a flamboyant ideology and set of religious beliefs that are known to us only from the magnificent burials of the Lords of Sipán (see [Figure 1.9](#) on page 18) and from detailed studies of sculpted and painted clay vessels crafted by Moche artisans (Alva and Donnan, 1993). Archaeologist Christopher Donnan attempted to decode the iconography behind the pottery, but succeeded in only the most general terms (Donnan and McClelland,

1979). For example, he identified a complex ceremony involving human sacrifice that was performed before warrior-priests wearing regalia precisely the same as that worn by the Lords of Sipán. The Sipán regalia reflect an ancient Andean duality between sun and moon, day and night, but to go into more detail without written sources is well-nigh impossible. Fortunately, some other exceptional studies of native South American religions, ancient and modern, give insights into such institutions as shamanism and ancestor worship in earlier times (Sullivan, 1989).

Research like Donnan's requires exceptional rigor, for it is all too easy to rely on intuition and aesthetic sense rather than demanding analysis. Another scholar, Olga Linares, has studied the ideology behind high-status cemeteries in central Panama. Using sixteenth-century Spanish eyewitness accounts of local Panamanian chiefdoms engaged in constant warfare and raiding and detailed information on local animal species, Linares (1977) studied graves and the flamboyant polychrome vessels found in them. They were open pots designed to be viewed from above, where mourners could see the animal motifs painted on them. Sometimes, apparently, the pots were so valuable that they were exhumed from one grave and put in another.

Ethnohistorical accounts mention that the highly competitive chiefs vied constantly for leadership and prestige, painting and tattooing their bodies with badges of rank and bravery. Each group of warriors wore distinctive symbols that associated them with their leader. They went to their graves with helmets, weapons, other military paraphernalia, and painted pottery. Linares noticed that the art styles rarely depicted plants, but rather many animal species, motifs that commemorated qualities of aggression and bravery. Crocodiles, large felines, sharks, stingrays, scorpions, and even poisonous snakes were the animals that were dangerous and, therefore, symbols of bravery. They often appeared on clay vessels, and sometimes parts of their bodies, such as sharks' teeth and stingray spines, were buried with the dead. In contrast, prey species and animals with soft parts, such as monkeys, were largely ignored by the artists. Thus, the Panamanian chiefdoms used carefully selected animals to communicate the qualities most admired in chiefs and warriors.

Most of what we know about ancient religion comes from literate

societies, where documents and inscriptions amplify the archaeological record in dramatic ways. We know a great deal about Mesopotamian and ancient Egyptian religion, but the most dramatic advances of recent years have come with the decipherment of Maya glyphs. For example, Linda Schele and David Freidel (1990, 1993) have studied Maya images and hieroglyphs and have used changes in them to trace changes in the meaning of symbols associated with political power. Among their ideas, they theorize that the religious symbolism of the late Preclassic period 2,000 years ago was based on the passage of Venus as morning and evening star with the rising and setting of the sun. The people of any Maya community could identify and verify their cosmos simply by observing the sky.

As time went on, Maya cosmology was expanded and elaborated. The names of late Preclassic rulers were not recorded publicly. Perhaps such permanent verification on public monuments had not yet been deemed necessary. Classic rulers followed a quite different strategy. They legitimized their rule through genealogies, public ceremonies, and monuments; much Classic Maya art was erected as part of this process of legitimizing rulers, who claimed identity with gods in the Maya cosmos. Schele and Freidel believe that the metaphor of the twin ancestors—Venus and the sun—provided a potent image for lateral blood ties between lineages, communities, and everyone who believed in the same myths. Just as twins are of the same womb and blood, so all Maya are of common ancestry and blood (see the Doing Archaeology box).

Research on Maya glyphs and archaeological sites shows that one should never think of religion and ritual in isolation but rather as integral to social organization, economic life, and political systems. The ideas and beliefs, the core of all religions, are reflected in many aspects of human life, especially in art and architecture. Every society has its own model of how the world is put together, its own ultimate beliefs. These sacred propositions are interpreted for the faithful through a body of associated theology and rituals. Many rituals are more or less standardized religious acts, often repeated at regular times of the year—harvests, plantings, and other key times (Eliade, 1954). Others are performed when needed: marriages, funerals, and the like. Some societies, such as those of the ancient Egyptians and the Maya, made

regular calendars to time religious events and astronomical cycles. These regular ceremonies performed important functions not only in integrating society but also in such activities as redistributing food, controlling population through infanticide, and dispersing surplus male cattle in the form of ritually accumulated wealth.

Religious experiences are predominantly emotional, often supernatural and awe-inspiring. Each aspect of religion—sacred propositions, ritual, experience—supports the others. A religion will operate through sanctified attitudes, values, and messages, an ethic that adds a sacred blessing, derived from the ultimate sacred propositions of the society, to elicit predictable responses from the people. Such predictability, sparked by directives from some central religious authority, ensures orderly operation of society. In time, as in Mesopotamia, that authority can become secular as well. The institutions and individuals associated with these messages can become sanctified, for they are associated with the sacred propositions that lie at the heart of the society's beliefs. As societies became more complex, so did the need for a stable framework to administer the needs of the many increasingly specialized subgroups that made up society as a whole. And architecture and sacred places played a central role in this ideological framework.

Doing Archaeology The Maya World Through Glyphs

The decipherment of Maya glyphs was a magnificent scientific triumph that resulted from inspired teamwork between epigraphers living in many countries (Coe, 2011). The process of decipherment continues to this day, to the point that we now have a rudimentary understanding of the intricate cosmology and religious beliefs of the ancient Maya, even if many details remain controversial (Coe and van Stone, 2016). The glyphs give us a new understanding of the complex, multilayered Maya world. Great cities such as Copán, Palenque, and Tikal depicted the geography of the sacred world. Maya glyphs tell us that the world was alive and imbued with a sacredness that was concentrated at sacred points, such as caves and mountains. The gods had created these spots when they created the cosmos. Living people built cities and communities within the matrix of the sacred landscape, which merged with divinely created patterns in caves and at the summits of humanly

raised pyramids. At the same time, the world of human beings was connected to the Otherworld along the axis of a World Tree, which ran through the center of existence. This axis moved constantly but could be materialized through powerful rituals at any point in the natural and human-made landscapes.

Glyphs tell us how Maya lords went into hallucinogenic trances atop pyramid-mountains. They gashed their penises with stingray spines, a bloodletting ritual that brought the World Tree into existence through the middle of the temple atop the pyramid. The temple doorway became a sacred entrance to the Otherworld. Here, the ruler would mediate between the people and the gods and ancestors. Clouds of incense rose high above the temple as the ritual unfolded. This was the Vision Serpent, whose twisting coils symbolized the path of communication that linked the living and supernatural worlds.

Maya artists depicted the cosmos on special tripod plates designed to catch the blood that helped open the door to the Otherworld. A great bearded serpent with gaping jaws emitted the pure, life-bearing waters of the earth. Below, the dark waters of the Underworld flowed, with the World Tree emerging from the head of the Eveningstar god as he rose from primordial black waters.

A new generation of Maya research is combining glyphs with archaeology in efforts to decipher royal genealogies, to identify the builders of temples and pyramids, and to untangle the complex political history of a flamboyant, volatile civilization.

Sacred Places

Notre Dame de Chartres Cathedral, France, built in a mere quarter-century in about A.D. 1195, is the sixth church built on the same site, and a masterpiece where the infinite became a miracle in stone and glass (see [Figure 17.7](#)). The cathedral is all windows, with the great rose window of the western front symbolizing the Virgin Mary, is all windows, the great rose window of the western front symbolizing the Virgin Mary. Stained glass windows were a major element in Gothic architecture, ethereal settings among soaring beams and graceful arches. At Chartres, they became a form of new language, bringing together ancient principle of Christianity, many of them derived from

even older cosmic beliefs. The rose was a powerful symbol that evoked soul, eternity, wheel, sun, and the cosmos. It was sacred to the Egyptian goddess Isis, to the Greek Aphrodite, and to Venus, as a symbol of human love transcending passion. The major rose windows at Chartres depict the Virgin and Child (north), martyrs who spread the Word and the New Testament (south), and the wounded Christ at the center of the Last Judgment (west). All use the same vocabulary of color, form, geometry, and symbol. The gemlike transmutation of the light shining through the windows creates transcendental effects that could heal and revivify worshipers crowded in the nave. The pictures in the windows communicate the message of God for the illiterate who come to pray.

As did ancient Egyptian artists, the medieval artisans followed a standard vocabulary of forms as far as the disposition of figures and backgrounds were concerned. They made use of unique geometrical compositions to structure the motifs of the windows, often with close ties to astrological and cosmological images and zodiacal symbolism. Chartres' windows were an integral part of a setting that brought heaven to earth and joined the secular and spiritual, as did the Aztec great temple at Tenochtitlán, Mexico, the Egyptian pyramids, and the Maya centers.

Figure 17.7 Notre Dame de Chartres Cathedral, France.

Source: Courtesy of Prisma by Dukas Presseagentur GmbH/Alamy Stock Photo.

Chartres served the same purpose as much older sacred places. The cathedral was a magnet. The permanent population of medieval Chartres may have been no more than 1,500 people. The cathedral regularly attracted 10,000 worshipers, an offering to God as powerful as the human sacrifices of the Aztecs and the propitiating killing of children for Minoan deities. The cathedral provided a way of connecting the divine to the living world, for all things emanated from the Kingdom of God. Requiring enormous expenditures of human labor and sometimes extreme deprivation, Gothic cathedrals were expensive outpourings of love for the Deity, as well as metaphorical sacrifices in stone and material goods offered in the expectation of divine favors in return. Chartres was the setting for dazzling spectacles. Sung masses and mystery plays depicting the life of Jesus or episodes in the lives of

saints brought on intense emotional reactions among the faithful. The great cathedral bells tolled at times of joy, at moments of mourning. They sounded warnings and rang out in exultation and in crisis. Great preachers attracted huge crowds. Baptisms, marriages, funerals and prayers for the dead, ordinations and excommunications, victory celebrations and public meetings—the cathedral was the focus of human life.

As did Mesoamerican Indians, medieval Christians worried about the fertility of the land, the continuity of life itself. Every Easter Eve, a New Light was kindled, celebrating the Resurrection and the year's start. A thousand tapers were lit and carried from town to village, village to household, as life renewed. Autumn harvest festivals saw churches decorated with the fruits of the soil, commemorating the bounty of the soil, reminiscent of the Green Corn ceremonies of eastern North American groups. Seven centuries ago, the medieval cathedral was the Bible of the poor, an image of the cross and of the body of Christ, a corner of God's kingdom.

Sacred places were among ancient humanity's greatest achievements, mirrors of their spiritual world. Great Maya cities such as Copán (see [Figure 9.13](#) on page 173) and Tikal (see [Figure 15.3](#) on page 291) were vast replicas of the spiritual world wrought in stone and stucco, with sacred mountains (pyramids), carved stelae (trees), and reservoirs (lakes). They were oriented with the heavenly bodies and were settings for elaborate ceremonies when powerful lords would appear before their subjects in trance. Angkor Wat in Cambodia is one of the masterpieces of the ancient world. Khmer King Suryavarman II erected Angkor Wat as an observatory, shrine, and mausoleum in the early twelfth century A.D. (see [Figure 16.5](#) on page 322). The temple honors Vishnu, ruler of the western quarter of the compass. The five multitiered towers of the temple depict Mount Meru, home of the gods and center of the universe. Celestial maidens twist and cavort in endless dances on Angkor's walls, depicting the pleasures of paradise. More than a dozen Khmer princes built their shrines near this sacred place.

The great temple or ceremonial center was the focus of human life, the sanctified terrain where scheduled rituals guaranteed the seasonal renewal of cyclic time and where the splendor, potency, and wealth of

rulers symbolized the well-being of the whole community. Such centers ensured the continuity of cultural traditions; the religious and moral models of society were laid down in sacred canons recited in temples in reassuring chants passed from generation to generation.

Such sacred places lay in the heart of much wider cultural landscapes, defined by generations of experience with supernatural qualities. They were the focus of much wider worlds, which is why settlement archaeology plays such an important role in the study of ancient religions. For instance, the celebrated stone circles at Avebury in southern Britain formed part of a much larger sacred landscape, defined not only by natural landmarks but also by burial mounds, sacred avenues delineated by stone uprights, and structures where the bodies of the dead were exposed before burial in communal tombs (see [Figure 8.1](#) on page 127). In recent years, teams of archaeologists have been gradually reconstructing this long-vanished, fragmentary landscape with survey and excavation that reveal its gradual evolution over many centuries (Whittle, 1993; Whittle et al., 1993) (see the People of the Past box).

Cahokia, Illinois

The great Mississippian center of Cahokia lies on the Mississippi floodplain near St. Louis in the heart of a pocket of extremely fertile bottomland known as the American Bottom. At the height of its powers, between A.D. 1050 and 1250, Cahokia covered an area of more than 5 square miles (13 sq. km), about the size of the ancient city of Teotihuacán in the Valley of Mexico (Milner, 1998). Several thousand people lived in pole-and-thatch houses covering about 2,000 acres (800 ha), clustered on either side of a central east-west ridge. More than 100 earthen mounds of various sizes, shapes, and functions dot the Cahokia landscape, most grouped around open plazas. The largest, Monk's Mound, dominates the site and the surrounding landscape. Monk's Mound rises in four terraces to a height of 100 feet (33 m) and covers 16 acres (6.4 ha), slightly larger an area than Egypt's Great Pyramid of 13 acres (5.3 ha) (see [Figure 17.8](#)). Fortunately for science, the ancient cosmology and religious beliefs behind Cahokia can be pieced together, at least partially, from a combination of archaeology in the American

Bottom and ethnohistory derived from historic southeastern Indian groups (Emerson, 1997; Pauketat and Emerson, 1997).

The layout of Cahokia reflects a traditional Southeastern cosmos with four opposed sides, as seen in the layout of their platform mounds, great mounds, and imposing plazas. By A.D. 1050, the rectangular plaza surrounded by mounds reenacted the ancient quadripartite pattern of the cosmos, seen in much earlier settlements along the Mississippi. Four-sided Mississippian platform mounds may portray the cosmos as “earth-islands,” just as modern-day Muskogean Indians thought of the world as flat-topped and four-sided. Archaeologist John Douglas uses ethnographic and archaeological data to argue that the four-sided cosmos had a primary axis that ran northwest to southeast, with an opposite axis dividing the world into four diamond-shaped quarters (Pauketat and Emerson, 1997). Cahokia is oriented along a slightly different north-south axis, but it certainly perpetuates the notion of spiritual links between opposites and a cosmos divided into quarters. Researchers believe the orientation reflects observations of the sun rather than the moon, as if Cahokia’s rulers used the sun to schedule the annual rituals that commemorated the cycles of the agricultural year (Aveni, 2008).

People of The Past Orkney’s Ritual Landscape

The Orkney Islands off northern Scotland are home to a spectacular cultural landscape. The area was famed for its two Neolithic stone circles, the Stones of Stenness and the Ring of Brodgar, and the communal sepulcher: the grassy mound of Maeshowe. However, in 2004, archaeologists led by Nick Card of the Orkney Research Centre for Archaeology, started to examine another feature: a vast artificial mound, some 5,000 years old, right between the Stones and the Ring. Known as the Ness of Brodgar, it has transformed our ideas of prehistoric religion on Orkney (Card and Thomas, 2012).

The Ness of Brodgar is the size of five soccer pitches and is formed of massive stone structures and domestic trash middens. The first stone structure to be uncovered was built of drystone and over 49 ft (15 m) long and 32 feet (10 m) wide (labeled “Structure 1”). It had three entrances and was remodeled several times, and contained many pieces of stone artwork. Some of the individual stones were also painted using

ochre pigment mixed with animal fat, milk, or eggs—the first evidence that British Neolithic people used paint to decorate their buildings. Copious amounts of midden material were subsequently dumped around this building, making it appear today somewhat subterranean.

Two other structures of comparable size and architecture were found nearby (“Structures 8 and 12”). However, a fourth structure was almost twice the size—at over 82 ft (25 m) long and almost 65 feet (20 m) wide (labeled “Structure 10”). The external walls of the latter were gigantic: almost 16 feet (5 m) thick and consisting of two stone-built walls, each 6.5 feet (2 m) wide, separated by a midden wall core. The stonework was of exceptional quality and included beautifully curved external walls. The monumentality of Structure 10, coupled with its central location on a mound, and its intervisibility with the two stone rings, the passage grave, and other contemporary ritual structures, have led many to describe it in terms of a Neolithic cathedral.

Certainly, its ancient significance is confirmed by other strands of evidence. First, geophysical survey revealed the presence of several other large structures on the mound. Yet once Structure 10 had been built, the others were leveled and filled in, presumably enhancing the new edifice’s domination of the landscape. Second, more than 120 stone panels, decorated with finely incised geometric art or graffiti, have also been found in the excavations. However, the more substantial of these—such as those decorated with numerous cup and cup-and-ring marks—were all found around Structure 10. Third, the mound is bounded to the north by a massive double-faced stone wall running the 320 feet (100 m) width of the narrow peninsula on which the site is located. Another wall, some 6.5 feet (2 m) wide, runs on a parallel course to the south. These walls appear to delineate a huge sacred space, and Structure 10 lies at its very heart. Also noteworthy is the rich assemblage of artifacts that has been recovered around Structure 10, including polished stone axes and mace-heads plus a wide range of beautifully decorated Grooved Ware pottery. And finally, the events surrounding its abandonment were quite extraordinary.

Figure 17.1a The Stones of Stenness.

Source: Courtesy of Doug Houghton Collection/Alamy Stock Photo.

Figure 17.1b The Ring of Brodgar.

Source: Courtesy of David Lyons/Alamy Stock Photo.

At around 2,400–2,200 BC, Structure 10, which may have been suffering from some structural instability, seems to have been “closed” in a major and unique episode of demolition. As part of this event, about 400 cattle were slaughtered—mostly represented by their tibias (shin bones). Their bones were cracked, probably to extract the marrow, suggesting a major feast involving lots of people. The spent bones were then laid around Structure 10 and an upturned cow skull placed within it. After the feast, the complete carcasses of several red deer were then placed on top of the cattle bones and the structure was destroyed (Smith, 2014).

Figure 17.1c Maeshowe.

Source: Courtesy of Doug Houghton Collection/Alamy Stock Photo.

When all the evidence is pieced together—the location; the scale, symmetry, and complexity of the architecture; the monumental enclosure wall; and the artifact assemblage; and the astonishing way in which the building was “closed”—the term *ritual* or *temple* seems inescapable. It may even be possible that the famous stone circles were, in fact, secondary features, peripheral to the central “Neolithic temple complex” at the Ness.

Current thinking further assumes ritual progression from one monumentalized space to another, symbolically representing a transition or rite of passage, most probably from life to death, or from the “Land of the Living” to the “Land of the Ancestors” (this is ongoing research, for constant updates on the Ness, please see www.nessofbrodgar.co.uk).

Whatever went on in the minds of the ancients, it seems that the sacred landscape must be interpreted in its entirety—as is the case at comparable sites, such as Stonehenge. Thus, turning to the other features, the Ness sits between the Stones of Stenness and the Ring of Brodgar. The Stones of Stenness comprise a towering circle of monoliths encircled by a large rock-cut ditch with a single entrance and an outer bank. In the center is a stone hearth. The nearby Ring of Brodgar is

much larger, and if completed, would have had more than 60 standing stones and two opposed entrances surrounded by a rock-cut ditch over 9 feet (3 m) deep and 148 feet (110 m) wide. Maeshowe is what is called a **passage grave**, in which a long entrance passage leads to a massive central chamber with three raised side rooms. (For another example, see the People of the Past box in [Chapter 7](#).) Four stone monoliths define the corner buttresses of the chamber, not structural elements but apparently of symbolic importance. This communal grave lay inside a wall and a ditch that, if flooded, gave an impression of an island within a larger landscape—a place of the dead, separated from the living world by its ditch and bank.

As for the people who worshipped here, in 1983, Colin Richards (2005) began a field survey to locate Neolithic settlements. The survey yielded surface scatters at several locations, including one, at Barnhouse, on level ground close to Maeshowe and the Stones of Stenness. Five years of excavation at the Barnhouse site revealed a farming village, radiocarbon dated to around 3100–2900 B.C. , a group of freestanding houses, each about 16 feet (5 m) across, roofed with turf and looking somewhat like low mounds. As the village developed, it acquired a concentric layout, with one group of dwellings surrounding an open central area, a second group on the periphery.

One structure, on the western side of the settlement, was much larger, about 42 feet (12.8 m) long and 32 feet (10 m) wide, more than twice the size of surrounding huts. A smaller house faced it across a narrow, paved passage, the doorways facing one another, as if there were a relationship between the two. The interior was quite unlike that of the dwellings, comprising six large recesses formed by corner buttresses, with two masonry piers that effectively divided the building into two symmetrical halves, each with a central fireplace. Someone entering the building did so on the east side, so that the western portion was the “deepest” space within it. The sophisticated masonry used in the interior recalls that of Maeshowe and the Ness. Thus, the structure may be associated with both the living and the dead, lying as it does on the western side of the settlement, toward sunset.

The people in this village, and others still undiscovered, may have seen themselves as part of a constantly changing landscape. However, during the 400-year occupation of Barnhouse, the Stones, the Ring, and

the Ness were conspicuous places set in the midst of the landscape. No question, the builders created them as durable structures, destined to last far beyond their lifetimes—which they have done. Their construction involved numerous people cooperating in the quarrying, hauling, and erection of the stone uprights, also complex social pacts that involved both individual and group prestige, and strong ties of obligation between families, kin groups, and entire communities.

Figure 17.1d Interior of Maeshowe, showing an upright.

Source: Courtesy of Doug Houghton Collection/Alamy Stock Photo.

The grassy mound of Maeshowe lies in full view a half mile (1 km) southeast of the village on slightly raised ground. The passage faces the southwest, the rays of the setting sun at the midwinter solstice illuminating the interior of the central chamber. Then the interior returns to darkness; the sun begins its return journey and again the interior is illuminated, perhaps in a process of symbolic rebirth shared with the ancestors. Thus, Maeshowe marked a fixed moment in the annual cycle of the agricultural year, the beginning of regeneration. The passage grave mound bears a close relationship to the nearby hill of Hoy, which dominates the landscape. Richards and his colleagues believe Maeshowe, the residence of the ancestors, was built to resemble the earth with its rock covered with soil, situated midway between the humanly inhabited world and the nether regions.

So, from 3300 B.C. onward, we see an entire ritual landscape, possibly centered on the Ness complex but involving the passage graves (several others are known in addition to Maeshowe), stone circles (henges), and standing stones, all probably erected over a 500-year period. Village architecture and the great monuments are closely related, so much so that the one is an extension of the other, just as the builders intended—a dramatic example of the continuity of human life from the living world into the realm of the dead, the ancestors, who were as much part of the cyclical world of the seasons, of planting and harvest, of life and death, as their successors.

The Stones of Stenness and the Ring of Brodgar, on either side of the Ness, lie on opposing promontories that separate two lochs. In turn, a natural bowl of hills surrounds them, so that both monuments appear

to be surrounded by water yet encircled by hills. Thus if you stand at the Ring of Brodgar, you have the impression of a circular landscape, where you can follow concentric rings out from the stone circle, to the ditch (potentially filled with water for much of the year), to the bank, and then the surrounding water and encircling hills, and overlooking the villages and lives of the local people.

Figure 17.1e The Ness of Brodgar. General view of the main trench looking southeast with the Stones of Stenness in the middle distance.

Source: © Orkney Research Center for Archaeology. Courtesy of Hugo Anderson-Whymark.

The ritual features are the surviving elements of what were once presumably the contexts for colorful, elaborate ceremonies that involved adornment, ceremonial clothing, and perhaps dancing and chanting. This spectacular monumental landscape resulted from cosmology, a way of understanding and viewing the world that came through the realities of human existence in small communities from across Neolithic Orkney.

Cosmology in historic Southeastern Indian societies revolved around dualities. In the case of Cahokia, these may have included the Upper and Lower Worlds and a powerful and pervasive fertility cult linked to commoners and the elite. These dualities were carried through to the smallest ritual centers. Changing settlement layouts imply that, at first, local communities and kin groups controlled fertility rituals in dispersed households divided into symbolic quarters, with ceremonial structures facing a central square. Later, centers display more formal layouts, with central plazas, elaborate sacred buildings, and storage and ritual pits filled with offerings made during fertility and world-renewal ceremonies. By this time, experts believe, power was passing from local kin leaders to a powerful elite based at Cahokia, a shift reflected in increasingly elaborate ceremonial architecture, residences for local leaders at local centers, and special mortuary complexes. Their carefully laid out centers brought two central ritual themes together: the spiritual realm of fertility and life and the validation of living rulers, who were intermediaries with the supernatural realm. Cahokia and other Mississippian centers reflect an ancient cosmology in a symbolic

language intelligible to noble and commoner alike.

Figure 17.8 Artist's reconstruction of the central plaza of Cahokia, Illinois, as it would have appeared at its peak, circa A.D. 1150.

Source: Courtesy of Cahokia Mounds State Historic Site, Illinois. Painting by Lloyd K. Townsend.

Astroarchaeology and Stonehenge

Astroarchaeology is the study of ancient astronomical observances (Aveni, 2008). The movements of the sun and moon and other heavenly bodies played an important role in many ancient societies, among them ancient Egyptian civilization, the Maya, and many Andean cultures. Astroarchaeology is an important source of information about ancient religious beliefs and cosmologies.

Astroarchaeology is a far cry from the crazy theories of cultists who claim that Egypt's Pyramids of Giza were a giant, highly sophisticated astronomical observatory run with computers. (Correspondence from such "theorists" lands in a file in my office named "Pyramididiots.") Modern research into ancient astronomy uses computer software to examine the sky over the Maya homeland on specific years and makes highly accurate observations of astronomical alignments at Stonehenge, Hopewell monuments in Ohio, and other sites known to have astronomical associations.

More nonsense has been written about the stone circles at Stonehenge, England, than about almost any other archaeological site in the world (Chippindale, 2004). (See [Figure 2.2](#) on page 29.) After more than three centuries of sporadic research, scientists are still deeply divided about the significance of this extraordinary monument, the prehistoric equivalent of a Norman cathedral, used and modified from about 2950–1600 B.C. Was it the center of some long-forgotten religious cult, or was it an observatory, a sophisticated place of dialogue with the sun and stars (Cleal et al., 1995)?

In the 1960s, Boston astronomer Gerald Hawkins (1965) used an IBM mainframe computer to plot the positions of 165 key points: stones, stone holes, earthworks, and other fixed points. He found "total sun [and moon] correlation" with a network of 13 solar and 11 lunar

alignments, all of them based on features of early, rather than later, Stonehenge, where the alignments were less precise. Hawkins called Stonehenge a “Neolithic computer” used for predicting lunar eclipses. From the archaeologists’ point of view, the fatal flaw in Hawkins’s reasoning was his assumption that any alignments he saw, as a twentieth-century astronomer, were also known to the original builders.

Was Stonehenge an observatory? One cannot speak of it in the same breath as sophisticated Maya observatories or of the builders as astronomers on a par with Babylonian priests. We have known since the seventeenth century that Stonehenge was aligned on the axis of the midsummer sun. But the stone circles were never an elaborate device for predicting eclipses or measuring the sky. Rather, Stonehenge reflects a distinctive idea of time, which revolved around the cyclical movements of sun, moon, and stars across the heavens, as indicators of the passing seasons (Aveni, 2008).

The farmers who built the later Stonehenge lived in a demanding environment where the passage of the seasons governed their lives. Every year, the eternal cycles of planting, growth, and harvest, of symbolic life and death, repeated themselves in endless successions of good and bad harvests, of drought and excess rainfall, of famine and plenty (Fagan, 1998). The people placed great store in death rituals, in reverence of the ancestors, the guardians of the land. They devoted enormous resources to the great stone circles in the midst of their sacred landscape, where their priests and shamans used the stone uprights and simple stone alignments to observe the passage of the seasons. At midsummer sunrise and, perhaps, on the shortest day of the year, about December 21, the priests stood at the open side of the horseshoes to observe sunrise or sunset. In winter, the setting of the winter sun at the solstice signaled the beginning of lengthening days and the certainty that the cycle of the seasons would begin anew.

Some clues as to the meaning of Stonehenge come from the discoveries at Durrington Walls a short distance away, a circle of ditches and earthen banks that once enclosed concentric rings of massive timber posts, effectively a wooden version of Stonehenge. The timber circle is aligned with the winter solstice sunrise. Built at the same time as Stonehenge, in about 2600 B.C. , Durrington Walls lies

close to the Avon River and is joined to it by a stone-paved roadway about 500 feet (152 m) long aligned with the sunset at the summer solstice. Recent excavations by a team from six British universities have uncovered eight houses at Durrington and located traces of many more dwellings (see [Figure 17.9](#)). The houses may be part of a large village of huts made of woven saplings and crushed chalk, each with a hard clay floor and a central fireplace. Animal bones and other refuse covered the floors, unlike those of two smaller structures, which were much cleaner, perhaps the residences of priests or other important individuals. The excavators believe that the village may have housed the builders of Stonehenge and Durrington Walls and also visitors to the sacred circles.

[Figure 17.9](#) An artist's impression of Durrington Walls in mid-winter, c. 2500 B.C

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Source: Courtesy of Arcaid Images/Alamy Stock Photo.

Finds are constantly forthcoming at Stonehenge but the most important new discovery at Stonehenge has been of a second stone circle—dubbed “Bluestonehenge”—at West Amesbury. It lies right at the point where The Avenue reaches the River Avon. The discovery of a major circle on the river’s edge appears to be confirmation of another long-held archaeological idea that the River Avon was part of a sacred routeway. For now, the river can be shown to link Stonehenge with The Avenue, and also onto the new discoveries of Bluestonehenge and Durrington Walls.

Just like the bluestone circle at Stonehenge itself, the newly found circle is built of bluestones from the Preseli Hills of Carmarthenshire. This represents a huge investment of resources in cutting, transporting, and erecting the monoliths. The circle comprises a 25 meter-wide henge monument (which, like Stonehenge, is a ditched enclosure with an external bank), at the center of which lay a 10 meter-wide ring of stones, represented today by a ring of pits filled with clay and flint nodules used as packing stones. In 2008–2009, the archaeological team excavated a quarter of the stone circle, identifying nine stone holes, whose curvature and spacing imply that the monoliths were placed 1.12 meters apart, and that originally there were up to 25 of them forming the complete monument. Two antler picks were discovered, and when

radiocarbon dates have been secured for these, a relatively precise date for the construction of the monument will be available. Meantime, the discovery of distinctive “chisel arrowheads” places Bluestonehenge in the period 3400–2500 B.C.

The investigations have been led by a team of experts that includes Mike Parker Pearson. He has advanced the argument (also relevant to the discoveries at the Ness of Brodgar in Orkney, see *People of the Past* box on pages 354–356) that the Stonehenge landscape represents a sequence of monuments associated with elaborate rites of passage in which the dead passed from the “Land of the Living” (perhaps symbolized by wooden structures) to the “Land of the Ancestors” (stone structures).

In this interpretation, we might envisage Stonehenge and Bluestonehenge, with their durable stone circles, as memorials for the dead, while Durrington Walls with its perishable timbers symbolizes the fleeting reality of human life. Perhaps the living congregated at Durrington to celebrate life and to deposit their ancestors in the nearby river. Whatever the reality, Bluestonehenge certainly adds another piece to this interpretive picture of the distant past.

Perhaps the lesson of Stonehenge lies in the continuities of farming life, rather than changes. Chieftains lived and died, achieved great power and supernatural authority, and in time, became ancestors. As villages prospered and more people crowded the densely farmed landscape, always at the center of this busy world lay a set of ancient values and beliefs epitomized by the shrines at Durrington Walls, Bluestonehenge, and Stonehenge itself. The seasons came and went, and so did human life itself, while Stonehenge remained an idea of time, a place where relationships between the living, the dead, and the supernatural were commemorated in stone.

Southwestern Astronomy and Chaco Canyon

Agriculture and religion intersected the lives of the ancient Pueblo Indians of the Southwest, living as they did in a region of unpredictable rainfall, where the timing of harvest and planting was everything. The Pueblo world was one of close interdependence between farming and religious observance and between isolated communities, large and

small. The major ceremonies of the summer and winter solstices brought people together in implicit recognition of this interdependence (Lekson, 1999).

The Pueblo tied their world to the horizon and the heavens by making a calendar out of the environment around them. The Hopi, for example, oriented themselves to the points on the horizon that mark the places of sunrise and sunset at the summer and winter solstices (Zeilik, 1985). The Pueblo anchored time and their ritual cycles to these events, especially to the winter solstice, when the sun is at its southernmost point. They believed that if the sun did not turn round, it would fall off into the underworld. Some groups observed a period of “staying still” to keep the sun in its winter house. Winter solstice ceremonies guided the sun in the correct direction. The sun priests set the days for these ceremonies, as well as the lesser celebrations in the annual calendar, starting their prayers and observations about 28 days before the winter solstice and 29 days before the summer. They used a chosen spot in the village for their work, tracking the sun’s seasonal position with the aid of horizon markers, which showed up clearly at sunrise. Sometimes, they employed windows in buildings to manipulate light and shadow.

Sun watching required much more than observation of solstices and other events. The sun priest had to make anticipatory observations over three weeks before an event, such as a solstice celebration to allow for preparations to be made. He also required lengthy training, so he could predict events during times of bad weather. This is why he had to know the position of sunrise relative to horizon markers several weeks before the event. At the solstice, the sun stands still on the horizon for four days, making the observation of the actual solstice day impossible beforehand. So the sun priest had to make his observations at a time when the sun was still moving perceptibly every day, in human-eye terms, about 10 minutes of arc (arcmins) a day. He could predict the day of the solstice by making the observation and then keeping a tally of days on a notched stick. This approach solved the problem of cloud cover and bad weather. By using any clear day well ahead of time, the observer could use his notched stick to calculate the correct day even if the sky was overcast.

Predictions of the summer solstice based on this method are remarkably accurate, almost invariably to within a day and a half. Such

accuracy was essential. A major disaster would occur if the ceremonies took place and the sun had already turned or was still moving toward its turning point, as if it were about to fall off the earth. Accurate predictions reinforced priestly power, strengthened bonds within the community, and validated the worldview.

Ecological time served the Pueblo well. They lived a well-regulated life attuned to the solstices and to the realities of their arid environment. The yearly cycle repeated itself endlessly. As one year ended, another began, measured in the passage of moons and days.

Fortunately for science, pre-Columbian astronomers used buildings, pictographs, and other human-manufactured objects for their observations, enabling us to trace Pueblo astronomy back to the Ancestral Pueblo (formerly called the Anasazi, “the ancient ones”) whose primordial roots extend back as far as 2,500 years ago.

The best archaeological evidence for Pueblo astronomy comes from Hovenweep Pueblo in Colorado, erected by Ancestral Pueblo people related to nearby Mesa Verde communities between the late twelfth and mid-thirteenth centuries. The pueblo includes round, square, or D-shaped towers. At least one, Hovenweep Castle, has special sun-sighting ports aligned with the summer and winter solstices. Nearby, Holly House contains petroglyph panels with symbols that may represent the sun and other heavenly bodies (Cordell, 2009).

The first farmers of the Southwest dwelt in small communities of pit houses. By A.D. 900, Southwestern farming populations rose considerably. Many Ancestral Pueblo communities moved into large, well-constructed towns, epitomized by the great pueblos of Chaco Canyon (Fagan, 2005). For two and a half centuries the Chaco Canyon pueblos flourished, during a time of constant climatic change. By 1050, the Chaco Phenomenon (an archaeological term) was in full swing. The Phenomenon expanded from its canyon homeland to encompass an area of more than 24,900 square miles (65,000 sq. m) of the surrounding San Juan Basin and adjacent uplands. Roads and visual communication systems linked outlying communities with the canyon. Great pueblos such as semicircular Pueblo Bonito housed hundreds of people (see [Figure 17.10](#)). The population of Chaco Canyon rose from a few hundred to at least 5,500 inhabitants, with many more people visiting for major ceremonies and trading activities.

During the 1970s and 1980s, aerial photographs and side-scan radar placed Chaco at the center of a vast ancient landscape (Cordell, 2009). Light detection and ranging (LiDAR) has now defined the road network even more precisely. A web of over 400 miles (640 km) of unpaved ancient roadways links Chaco with more than 30 outlying settlements. The Ancestral Pueblo had no carts or draft animals, but they built shallow track ways up to 40 feet (12 m) wide, cut a few inches into the underlying soil or demarcated by low banks or stone walls. Each highway runs straight for long distances, some as far as 60 miles (96 km), each linked to a major pueblo at the canyon itself. The people approached the canyon along straight walkways, descending to the pueblos down stone-cut steps in the cliffs.

The Chacoan “roads” are a mystery. Were they used for travel or transportation of vital commodities? For years, archaeologists have argued for some form of integrating Chacoan cultural system that would have unified a large area of the Southwest 1,000 years ago (see the papers in the journal *Kiva*, 83(1), 2017). One authority, archaeologist James Judge, believes that the San Juan Basin’s harsh and unpredictable climate, with its frequent droughts, caused isolated pueblos to form loosely structured alliances for exchanging food and other vital commodities. Chaco lay at the hub of the exchange system and also served as the ritual center for major rainmaking ceremonies and festivals. The canyon’s Great Houses were the homes of privileged families who were able to predict the movements of heavenly bodies and controlled ritual activity.

In Judge’s scenario, the roads were pilgrimage and trading walkways (see the summary of arguments in Vivian, 1997). However, archaeologist John Roney of the Bureau of Land Management points out that there are no signs of domestic rubbish or encampments along the roads. On the ground, he has followed many of the fuzzy lines on air photographs, verifying more than 60 road segments, many of them short and without specific destination. Roney is certain that major north-south tracks radiated from Chaco, but he is cautious about joining segments into long lines uniting distant places on the map. He is sure of a mere 155 miles (250 km) of roads and believes that the Chacoans constructed the walkways as monuments, as a ritual gesture, not to be used.

Figure 17.10 Pueblo Bonito in Chaco Canyon, New Mexico.

Source: Courtesy of Shutterstock.

Do roads have to lead to a destination, as we Westerners always believe? The answer to the Chaco road mystery may lie not in the archaeological record but in Pueblo Indian cosmology. The so-called Great North Road is a case in point. Several roadways from Pueblo Bonito and Chetro Ketl ascend Chaco's north wall to converge on Pueblo Alto. From there, the road travels 13 degrees east of north for about 2 miles (3 km) before heading due north for nearly 30 miles (48 km) across open country to Kutz Canyon, where it vanishes. North is the primary direction in the mythology of modern-day Keresan-speaking Pueblo peoples, who may have ancestry among Chaco communities. North led to the place of origin, the place where the spirits of the dead went. Chaco's Great North Road may have been an umbilical cord to the underworld, a conduit of spiritual power. Another Pueblo concept, that of the Middle Place, was the point where the four cardinal directions converged. Pueblo Bonito, with its cardinal layout, may have been the Middle Place.

The Great Houses and trackways of Chaco Canyon may have formed a sacred landscape, a symbolic stage where the Ancestral Pueblo acted out their beliefs and commemorated the passage of seasons. Fortunately, new scientific technologies such as LiDAR and the geographic information system (GIS) are combining multispectrum imagery, color infrared photographs, and 1930s half-tone images. By enhancing different light, heat, and vegetational conditions, fieldworkers can go into the field with information on hitherto invisible features, locating themselves on the ground with the satellite-driven global positioning system (GPS), which can fix their position within a few feet. A new generation of survey work will establish the true extent of Chacoan roads and place them in a precise topographical context.

It is hard for us to reconstruct the intangible religious beliefs of the remote past, separated as we are from them by many centuries. Just how hard can be imagined by listening to modern-day storytellers as they recite well-known tales to an audience that has heard them again and again but never tires of the story and its morals. I have heard Pueblo Indian storytellers recite from memory, face to face with their

audiences, often for as long as an hour at time, holding their listeners spellbound with tales that bind living people to the world of the sun and the moon, of animals and plants like humans. The plots twist and turn, with heroes and terrifying hazards, tests of skill and wisdom. Almost invariably, the tale involves deeply felt religious beliefs and the spiritual world. Only a fraction of these tales survive, lovingly transcribed, edited, and translated as a permanent record of a vanishing world. Many tell of the sun, whose powers of warmth and light sustained life itself. One Hopi tale recounts how a young man was conceived by the Sun and journeyed to visit his father. After many adventures, including a journey across the heavens, he returned happy: “I saw for myself how he attends to our needs every single day of our lives. Therefore we must live out our lives in a good manner, and he will never forsake us” (Swann, 1994: 678).

Fortunately, a new generation of archaeological research is beginning to study the fascinating and complex world of the ancient intangible (see the Discovery box on page 362).

DISCOVERY The 'Ain Ghazal figurines, Jordan

Studying ancient religious beliefs using only material remains is one of the hardest challenges for an archaeologist. Fortunately, an occasional remarkable discovery yields compelling evidence for the intangible. The village of 'Ain Ghazal in Jordan was a flourishing community of cereal farmers and goatherds before 7500 B.C. The site was discovered during road work on the edge of modern-day Amman. The excavations yielded well-planned dwellings and even the toe bones of goats with scarring caused by the tethering ropes used in their pens.

The most remarkable 'Ain Ghazal discovery came in 1974, when archaeologists Gary Rollefson and Alan Simmons discovered a cache of badly fractured, plaster human figures in an early farming settlement. The figures date to about 7000 B.C. They look like department store mannequins with square, stylized torsos supporting lifelike shoulders and long necks with heads that bear calm, expressive faces. The incised eyes, inlaid with bitumen, stare into space in an almost eerie fashion (see [Figure 17.11](#)). Some figures had two heads, as if they memorialized a husband and wife or dual deities.

No one knows exactly what the figures were used for, but there is

good reason to believe that they were revered ancestor figures in farming societies with close ties to the land, which was farmed by the same families for many generations. Rollefson and Simmons believe that the figures may once have worn garments, perhaps cloaks or ceremonial gowns that covered their torsos and nonexistent arms. Headdresses or long scarves may have adorned their heads.

Whether ancestors, gods, or just prominent individuals, the 'Ain Ghazal figures once commemorated powerful but intangible beliefs that have long vanished into oblivion. They offer a good example of the challenge facing archaeologists studying ancient human beliefs.

Figure 17.11 An 'Ain Ghazal figurine.

Source: Courtesy of Peter Horree/Alamy Stock Photo.

Summary

1. Archaeologists study the religious beliefs of ancient societies by using material remains and information from a variety of sources. Many ancient religions shared common features: a multilayered cosmos, a cyclical existence, important locations that were axes of the world, and a concern with ancestors and shamanism.
2. Cognitive archaeology studies both the cognitive abilities of early hominins and Archaic humans and the cognitive aspects of modern human behavior. It is an approach to cosmology, religion, ideology, and iconography based on rigorous analysis and data from many sources.
3. Ethnographic analogy plays an important role in studying ancient rock art, thanks to anthropological research among the San of southern Africa a century ago. Richly adorned burials can provide information on religious beliefs as well as social ranking, but the major source of such information comes from art and artifacts. The context of artifacts in time and space is of vital importance, because it can often reveal more information than the objects themselves.
4. Rigorous studies of art styles, such as that of the Moche of Peru

or the Maya, can yield valuable information on ancient ideologies, especially if combined with ethnographic or written records.

5. Artifacts and art styles offer valuable insights into ancient religious beliefs through their use of standardized themes. Sacred places such as Cahokia, Illinois; medieval cathedrals; or Maya cities were vital catalysts for religious beliefs, for they were the settings for rituals of validation and other ceremonies.
6. Settlement archaeology plays an important role in studying such locations in the context of their wider landscape. So does astroarchaeology, the study of ancient astronomy, notably successful in the American Southwest; at Stonehenge, England; and with the Maya civilization.

Further Reading

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PART VI

MANAGING THE PAST

We have almost completed our journey through the complexities of contemporary archaeology, a journey that should leave you with some insights into the processes of archaeological research. Our discussion of contemporary archaeology would be incomplete, however, without considering the management of the past and the role of archaeology in the contemporary world. A major crisis confronts archaeologists: destruction of finite resources. [Chapter 18](#) is devoted entirely to the management of the past, while [Chapter 19](#) examines the many roles of archaeology in today's world. Finally, [Chapter 20](#) is a brief essay on careers in the field.









18

Cultural Resource Management (CRM) and Public Archaeology

CHAPTER OUTLINE

Legislating the Past

What is Protected?

Phases of Site Management

Management Versus Research

Strategies of CRM Research

Management Challenges

Public Involvement and Public Archaeology

Native Americans and CRM

Cultural Resource Management around the World

The city of York in northern England has been the subject of major urban excavations for a generation. Clifford's Tower, all that remains of the castle

built by William the Conqueror stands in the foreground.

Source: Courtesy of Skyscan Photolibrary/Alamy Stock Photo.

As we saw in [Chapter 1](#), archaeology in North America has turned from a purely academic discipline into a profession as much concerned with conservation and management of the finite resources of the past as it is with the pursuit of knowledge for knowledge's sake (Green and Doershuk, 1998).

Archaeology is under siege, and has been for generations. The fragile and finite archives of the past have been under accelerating threat ever since the rapid expansion of industrial civilization in Europe and the Americas during the nineteenth century. The problem has assumed epochal proportions since the 1960s; the pace of wholesale destruction has accelerated as urbanization has become universal and global populations have mushroomed. Add a frenzy of road construction to ease traffic congestion, rapid urban expansion, and the intensification of strip mining and industrial-scale deep plowing to the equation, and you have a scenario for wholesale destruction. The looting of sites for salable antiquities further threatens the rapidly evaporating record of the past. In many areas, the situation has reached crisis proportions. It has, for example, been estimated that less than 5 percent of the pre-1850s archaeological record of Los Angeles County remains undisturbed. Many years ago, Charles McGimsey (1972) estimated that at least 25 percent of the sites that existed in Arkansas in 1750 were destroyed by agricultural and other land use, to say nothing of looters, between 1962 and 1972. Despite herculean efforts to stem the tide, the destruction has continued since then.

In North America, we're now at the point when the management and stewardship of precious archaeological resources has become the primary form of archaeology practiced in the United States and Canada. This chapter is principally concerned with cultural resource management (CRM) in the United States, where most of our readership resides. But CRM and cultural heritage are of worldwide concern.

Legislating the Past

Cultural resources are the human-made and natural features

associated with human activity (Figure 18.1). They are the unique and nonrenewable sites, structures, and artifacts that make up the material record of the human past. CRM is the application of management skills to preserve important parts of our cultural heritage of all time periods for the benefit of the public today and in the future.

The first formal legal efforts to preserve America's past began with the passage of the Antiquities Act of 1906, which was primarily aimed at controlling a lucrative trade in painted pueblo pots from the Southwest. Unfortunately, this act only extended protection to archaeological sites on land owned or controlled by the U.S. government; archaeological resources located on nongovernment lands continued to be looted. These matters remained until 1935, with the passage of the Historic Sites Act, when widespread archaeological surveys in areas threatened by federal dam projects yielded a mass of information on site distributions and key cultural sequences before the sites where they occurred vanished forever under man-made lakes.

Since World War II, the accelerating destruction of archaeological sites throughout North America has resulted in a jigsaw pattern of legislation that serves as a framework for CRM, which has emerged as a sophisticated phenomenon, its practice surrounded by an elaborate framework of laws, regulations, and statutes, not only at the federal and state levels but also at the county, city, and Native American tribal levels (Neumann et al., 2010; Neumann and Sanford, 2010). Such local laws have become essential to dealing with looting and an explosion of destructive urban development, as well as with additional concerns such as public education and the repatriation of Native American skeletal remains. CRM archaeology is now an enormous enterprise, ranging in scope from multimillion-dollar projects to small-scale operations involving no more than a small urban plot or a simple survey of a few acres of farmland (see the Discovery box on page 366). It should be stressed, however, that the laws only apply to publicly owned lands. The United States is the only country in the world that extends no protection to archaeological sites on privately owned land—for constitutional reasons.

In some instances, private groups have also played central roles in the protection of resources. The Archaeological Conservancy, mentioned in Chapter 19, is a bright hope. It is a privately funded

membership organization that purchases threatened archaeological sites and manages them as permanent archaeological preserves on 100-year management plans.

Although local situations vary, it is federal CRM legislation that provides the principal means of protecting the nation's cultural resources. The most important federal legislation—including the National Historic Preservation Act, National Environmental Protection Act, Archaeological Resources Protection Act, Abandoned Shipwrecks Act, and Native American Grave Protection and Repatriation Act—is discussed in the Doing Archaeology box on page 368.

All of this legislation has led to a dramatic explosion in the amount of archaeological effort, much of it contracted by government agencies as well as by private companies undertaking development work. Whereas 50 years ago most archaeologists in the United States were employed by universities or museums, today the majority work in a variety of federal and state departments and private companies concerned with CRM (Zeder, 1997). The money expended on the salvage and mitigation of archaeological sites has resulted in some of the largest excavations in recent history and in some of the most innovative approaches to remote sensing and scientific applications.

Figure 18.1 The Great Serpent Mound, Hopewell, Adams County, Ohio, an early example of archaeological conservation. This remarkable monument, a depiction of a serpent devouring a burial mound, was saved by the efforts of Harvard archaeologist Frederick Putnam and a group of Boston women in 1886. In recent years, the mound was again saved from development through the concerted efforts of local archaeologists.

Source: Courtesy of University of Saskatchewan Library, University Archives and Special Collections, MG410: Courtney Milne Fonds, 471–119, Great Serpent Mound, Aerial.

DISCOVERY The Joint Courts Archaeological Project, Tucson, Arizona

The Joint Courts Archaeological Project in downtown Tucson, carried out by Statistical Research, a large CRM company based in the city, uncovered the Alameda-Stone historic cemetery, used between about

1862 and 1881. The project was one of the largest cemetery investigations ever carried out anywhere. The project also involved the investigation of a large residential and commercial complex, and traces of early Native American settlement and early agriculture going back over 4,000 years (Heilen and Gray, 2010). An area of 4.3 acres (1.7 ha) was totally excavated down to cultural sterile soil, this to guarantee that all human remains in the area were recovered. The entire project was mind-bogglingly complex, not only archaeologically but also because of the amount of advance planning, consultation, and archival research required—this, in part, because of the need to be respectful to the many stakeholders' interests and to comply with differing requirements for reburial and repatriation.

The Alameda-Stone cemetery housed the dead from many groups with a variety of different perspectives about how to treat the graves. The various cultural groups actively voiced their preferences regarding the treatment of disinterred individuals. Native American descendants preferred that the deceased be left undisturbed and in place. In the event that disinterred Native American individuals had to be moved—which they ultimately were—no photographs were to be allowed. Hispanic descendants welcomed scientific investigation so they could learn as much as they could about their forebears. They were also pleased that the cemetery was being moved from the heart of the present city in a neglected urban lot to a specially set aside portion of a modern cemetery on the eastern outskirts of town, where the dead could be memorialized and honored. Exceptional attention to detail was needed to cater to these differing needs. The project proponent, Pima County, funded the \$15 million archaeological and repatriation project and the \$1 million reburial and memorialization project. Pima County was anxious to move the cemetery both to comply with the law and to satisfy the needs of stakeholders. In response, Statistical Research developed as accurate and detailed records of the finds as possible, tracked them throughout the project, reported daily on burial discoveries, and carried out a comprehensive bioarchaeological analysis of the skeletal remains using state-of-the-art methods.

Virtually all of the cemetery that had not been previously destroyed was excavated, yielding one of the largest systematically investigated burial samples from any cemetery in North America. The excavators

recovered 1,044 individuals in graves and the fragmentary remains of several hundred others perhaps half to three-quarters of the people originally buried in the cemetery (Figure 18.2). The Alameda-Stone cemetery lay at the northeastern edge of Tucson, about 275 yards (250 m) northeast of the old Presidio graveyard. In contrast to the burial spaces created by earlier practices—which crowded graves into what were basically churchyards and led to frequent disturbance of earlier burials—the new burial ground was more spacious. The cemetery was divided into a military section, surrounded by an adobe wall in about 1868, whereas the civilian portion had a wall on the western and northern sides. It came into use at a time when suburban cemeteries were coming into fashion, partly because of crowding, but due to sanitary concerns. Excavations revealed a relatively orderly layout, with graves lying in meandering north-south rows. Many of the burials were apparently marked, the markers only being removed when the area was graded for residential construction after the cemetery was closed in 1875. In any case, historical records reveal that many of the markers deteriorated rapidly or were vandalized.

Figure 18.2 Overview of the Joint Courts Archaeological Project Area, Tucson, Arizona.

Source: Courtesy of Statistical Research.

The northern parts of the cemetery were devoted mainly to the local, largely Catholic community, whereas the military and southern portions were more representative of recent immigrants. The former contained burials of both sexes and all ages, whereas what appears to have been the immigrant section housed mainly adult males. Interestingly, nearly all religious artifacts such as crucifixes came from the northern precincts. There were crowded burials in one of the northern areas as well, the pits densely packed and often disturbed by later interments, practices nearly identical to those of the earlier churchyards cemeteries—Baroque Catholic practice. In contrast, those from the southern areas were spaced more widely and were less disturbed, perhaps reflecting later practice, as well as the influence of Protestant perspectives on burial, although the cemetery was only used for a short time. The contrast may also reflect a growing rift between

the local Hispanic community and Euro-American settlers. By 1875, a crowded small town had become a segregated community with separate Hispanic and Euro-American neighborhoods. Despite the differences among burials in different areas of the cemetery, there were some overarching similarities as well. Throughout the cemetery, people were nearly always buried in their clothes and on their backs in simple wooden coffins.

The bones of the dead were a mine of information on what was a hazardous place to live. People buried in the northern graves tended to have a grittier diet. Men's bones show more stress on the back and elbows, women's on the knees. Hispanics showed more signs of stress from hard physical labor than Euro-Americans, who held most of the jobs. Broken and dislocated bones were commonplace in the cemetery, many of them resulting from hazardous physical activities, such as working around cattle and horses. What was unexpected was the low incidence of weapon injuries, given that Tucson was notorious for its gun violence. There was, however, evidence for injuries from stone projectile points, fired ammunition, knives, and blunt instruments. Historical records and the skeletons tell of a population subject to numerous infectious diseases that spread easily as towns like Tucson grew in population and people from all over the world traveled to these growing centers, carrying disease with them. Numerous disease epidemics swept through the town, sometimes taking the lives of entire families. Women and children, in particular, experienced high mortality rates from childbearing and disease, but individuals of all ages were likely affected by the recurring epidemics and relatively poor sanitation common to many cities of the time.

Once the civilian cemetery was abandoned on May 31, 1875 and the military six years later, it was graded and built over, which raises a fascinating question. Why did the people of Tucson allow this to happen and the cemetery to be neglected and ignored? There were probably multiple causes. Drought, the withdrawal of the military presence, and mine failures in the 1880s led to population loss; the town needed tax revenue; the Euro-American newcomers who came to Tucson had no emotional connections to the land. Between 1890 and the 1920s, the cemetery was a residential neighborhood, most property owners being Euro-Americans, many of them immigrants. Then the

area became a commercial precinct, but, amazingly, through all these years, much of the cemetery remained undisturbed.

The Joint Courts Archaeological Project is a remarkable example of a state-of-the-art CRM project carried out to the highest ethical and methodological standards. Tucson learned a great deal about a place that was used and reused over thousands of years and right into the twentieth century. At the same time, the project repatriated the people buried in the cemetery to their descendant groups and to the U.S. military. All human remains and funerary objects recovered from the project area have been reburied respectfully in new cemetery locations. At the same time, the four-year project answered important questions about the past and served the diverse needs of the modern city.

What is Protected?

Most Americans likely assume that the nation's historic sites and archaeological resources are well protected and safe for archaeologists to study and for future generations to enjoy. However, the actual protection that cultural resources are afforded differs from state to state and from site to site. The legal compliance process on a project is, at best, an attempt to see that cultural resources threatened by the project are properly managed—recorded, evaluated, protected, or, if necessary, salvaged (King, 2012).

The legal basis for the protection of archaeological sites continues to be modified, but there are many gaps. While the United States has better CRM legislation than some countries do, it lags behind some others in protecting cultural resources. The Archaeological Resources Protection Act of 1979, which gives federal resource managers and prosecutors access to stringent criminal and civil penalties, was passed relatively recently. Until that time, the United States had no laws forbidding the export of antiquities. Penalties for looting have slowed the destruction of sites on public lands. The Abandoned Shipwrecks Act of 1988 has finally extended a degree of protection to shipwrecks in U.S. waters, though not before incalculable damage was done by professional treasure hunters and amateur divers. Even now, certain types of development still threaten these resources.

Doing Archaeology Some Cultural Resource Management Legislation in the United States, 1966 Onward

This is a summary of some of the key features of federal legislation, which built on the Historic Sites Act of 1935. This baseline act gave the National Park Service a broad mandate to identify, protect, and preserve cultural properties (King, 2012). Numerous state, local, and Native American tribal laws amplify and complicate this already complex legislative picture. (For an excellent summary of federal legislation, see www.nps.gov/archeology/public/publicLaw.htm.)

National Historic Preservation Act (NHPA)

This act, first passed in 1966, set up a national framework for historic preservation, requiring the federal government to establish a nationwide system for identifying what are commonly called “historic properties.” The act called for the establishment of the National Register of Historic Places (a “historic place” could include archaeological sites of all ages) and required federal agencies to protect Register properties when development projects were planned.

National Environmental Protection Act (NEPA)

NEPA, enacted in 1969, laid down a comprehensive policy for government land-use planning and resource management. It requires federal agencies to weigh environmental, historical, and cultural values whenever federally owned land is modified or private land is modified with federal funds. NEPA ordered all federal agencies to locate properties that might qualify for the National Register. They were also to develop programs to contribute to the protection of important historic properties on nonfederal lands. The act defined requirements that made it essential for archaeologists to prepare and maintain extremely comprehensive information on archaeological resources on state, federal, and privately owned land. This information would enable them to assess, at short notice, the potential effects of development on these resources. In addition, the states had developed historic preservation programs of their own, as required by the National Historic Preservation Act of 1966.

Section 106 of NEPA is the key section, for it requires compliance with the law and governs how it is achieved. The Advisory Council on Historic Preservation is the key agency that issues the regulations for Section 106.

Archaeological Resources Protection Act (ARPA)

ARPA, passed in 1979, gave more stringent protection to archaeological sites over 100 years old on federal land. People removing archaeological materials from federal lands without a permit are committing a felony and can be fined up to \$10,000 and sentenced to a year in prison. The penalties rise sharply when more valuable finds are involved. This legislation is aimed at commercial vandals; it does not forbid individuals from removing arrowheads “located on the surface of the ground.” Unfortunately, it gives no protection to archaeological resources on privately owned land. Amendments to ARPA in recent years have tightened the definition of what constitutes an “archaeological resource” and have legislated far more severe penalties for violations of the original law.

Abandoned Shipwreck Act of 1987

This act extends protection to shipwrecks and defines ownership of abandoned vessels in state and federal waters more clearly. It is an important weapon in the fight against unauthorized looting of shipwrecks—looting that all too often masquerades as “underwater archaeology” (see [Figure 18.3](#)).

Native American Grave Protection and Repatriation Act (NAGPRA) of 1990

NAGPRA requires all museums and institutions receiving federal funds to inventory their holdings of Native American human remains, funerary objects, sacred objects, and what are called “objects of cultural patrimony” in the collections they control. They must establish, as best they can, whether their individual holdings have cultural affiliations, or, in the case of skeletons, lineal descendants in living Native American groups. If relationships are established, the institutions are required to notify the relevant Native American organization about the existence of

the materials and offer to repatriate them. NAGPRA also protects all Native American graves and other cultural objects found within archaeological sites on federal and tribal land. This requirement encourages the in situ preservation of archaeological sites, or at least those parts of them that contain graves. It also requires anyone carrying out archaeological investigation on federal and tribal lands to consult with affiliated or potentially affiliated Native Americans concerning the treatment and disposition of any finds, whether made during formal investigations or by accident.

Figure 18.3 Underwater archaeologists battle constantly against unauthorized looting of ancient shipwrecks, which enjoy only limited protection against disturbance.

Source: Courtesy of Gavin Parsons/Alamy Stock Photo.

The ethics of archaeology demand that as many sites as possible be preserved. Ideally, sites are not threatened by development and are excavated on the basis of scientific considerations and with clear research designs. However, in reality, many other variables—project budgets, mitigation costs, public interest, and project design alternatives, to mention only a few—come into play when sites are threatened by imminent destruction.

Then there is the problem of “secondary impacts,” when unexpected spin-offs of the main project destroy unprotected resources outside the main project area. Don Fowler (1987) cited the classic example of the monstrous, and later canceled, MX missile project in the Great Basin, which would have affected archaeological resources in no fewer than 23 valleys in the region. Although the project would have primarily affected sites in the lowlands, the archaeologists pointed out that most of the sites lay in the foothills and uplands nearby. These sites would have been affected disastrously by secondary activities such as seismic testing, survey work, and the sheer numbers of construction workers and military personnel brought into the area during the MX project. Whether effective ways of mitigating these secondary impacts would have been possible is questionable. Few, if any, agencies consider such impacts, but they are often critical to archaeologists.

In general, archaeological sites on government lands, including

national and state parks, forests, reservoirs, and military bases, are well protected. These areas are required by law to have management plans in place, and an active effort is made to document and protect their archaeological resources. Government archaeologists oversee development and contract private archaeologists to conduct work. Some of the nation's best-documented and best-protected archaeological sites, albeit somewhat inaccessible to the public, are located on military reservations. A case in point is the China Lake Naval Air Weapons Station in southern California, site of the Coso Petroglyphs National Historic Site, which includes some of the nation's most spectacular rock art (Whitley, 1998). The sites are open to the public only through special arrangements on a limited basis, for information go to www.nps.gov/archeology/rockArt/index.htm.

The largest gap in cultural resource protection in the United States is on private lands. Despite the comprehensive appearance of antiquities legislation, for the most part it remains focused on government lands and development projects requiring government funding and permits. In many countries, antiquities are considered the property of the state regardless of where they are found. In contrast, the law in the United States is ambiguous because the Fifth Amendment to the U.S. Constitution forbids the seizure of private property for public use without just compensation. Private property is almost sacrosanct, and over the years, archaeological resources on private land have come to be thought of as part of that land and, therefore, the private property of the owner. The power of eminent domain, zoning, easements, tax incentives, and even laws concerning burials are tools that may be used to protect cultural resources on private land. Yet these tools were designed to meet other needs and are irregularly and inadequately applied to CRM concerns. For strategies for protecting archaeological sites on private lands, see www.cr.nps.gov/hps/pad/strategies/index.htm.

Although many owners take the preservation of archaeological resources on their land very seriously, others do not. Unrecorded sites may be unknowingly plowed over, while others are destroyed by landowners who regard sites as sources of income. As legal and official pressures on looters and pothunters increase, prices in the auction room and on the illegal market go up. More and more sites on private and

public lands are being mined secretly for profit. Among the pieces most in demand are the beautifully painted Mimbres ceramics from the valley of that name in New Mexico (see Figure 13.15 on page 267). Almost all major Mimbres sites, including those on federal and state land, have been ravaged in recent years, many with backhoes. The pace of damage is accelerating.

It is in the West that the most extensive damage has been done, for the stunning basketry and pottery of Southwest Native Americans have attracted collectors and dealers for more than a century. One Anasazi basket alone went for \$152,000 in a London auction room some years ago, while a Mississippian stone ax was sold in New Orleans for \$150,000. Even relatively prosaic vessels may be worth several hundred dollars, so there is a flourishing commercial, but underground, trade, which is probably a network of well-connected operators. Their work may not lead to fabulous profits, but it does yield enough to keep the enterprise alive. The situation is eerily like that of the drug trade. A crackdown in the field leads to higher prices; in the case of American Indian artifacts, there are plenty of wealthy private collectors at home and overseas who care nothing about ethics. Native Americans have long fought against such activities, which they regard as sacrilege, theft of their native patrimony, and common greed. Today, archaeologists and Native Americans are developing a sometimes uneasy alliance against a common enemy—the looter.

Phases of Site Management

CRM and the archaeological research that goes with it are but one component of a much larger enterprise: the consequences of human activity on the entire landscape (Adovasio and Carlisle, 1988). In this context, decisions concerning the finite archaeological record are part of the greater concern for the fragile ecology of North America and human impact on the environment. Indeed, the National Environmental Protection Act (NEPA) provided the legal framework for **environmental impact statements**, the studies required for all major federal and state projects that can affect human life on earth. CRM work often takes place within this context.

The process of identifying, assessing, and managing archaeological

resources is often discussed in terms of three phases that reflect increasing levels of archaeological fieldwork and research (Hardesty and Little, 2000; Neumann and Sanford, 2010). The objective of each phase is to evaluate the cultural resources present on the basis of the research undertaken and to make recommendations concerning the management of the resources and the need for additional archaeological fieldwork.

Phase 1: Identification and Preliminary Assessment

Phase 1 provides the preliminary identification and assessment of cultural resources within a project area. It may also be referred to as a reconnaissance survey or a cultural resource inventory. An overview of cultural resources within the project area is compiled, ideally including environmental background, the known culture history of the area, a review of previous research, and a description of relevant historical and ethnographic information. The survey area is clearly laid out on maps, and landowners within the study area are contacted concerning the project.

Phase 1 archaeological fieldwork is aimed at identifying the distribution, horizontal extent, and cultural affiliations of the archaeological resources present. This is done through surface survey and limited subsurface testing, such as shovel test pits (STPs). Using this information, the authors assess the research potential of the area, that is, the potential presence of undisturbed archaeological deposits, and make management recommendations. If the assessment indicates that the area has been highly disturbed by previous construction, or if no evidence of cultural materials is found, the Phase 1 report may recommend that no further work be undertaken, and development work begins. Alternatively, the preliminary study may suggest the possibility that significant resources may be present and Phase 2 research is recommended.

Phase 2: Assessing Significance

The focus of Phase 2 research is on determining the significance of the archaeological resources present and their eligibility for listing in the National Register of Historic Places. Fieldwork involves the

examination or reexamination of sites identified by previous research or during the Phase 1 work. It may include clearly specified surface collection, limited test excavations, deep trenching to identify buried deposits, and the stripping of disturbed surface deposits to reveal buried features. The specific objective is to determine the presence of stratigraphically intact archaeological deposits and to assess the potential significance of the site in terms of its contribution to the understanding of an important person or event, or the culture represented. The completed Phase 2 report discusses the cultural resources identified with regard to the relevant CRM legislation and makes recommendations regarding their eligibility for the National Register of Historic Places.

Phase 3: Management Plans and Data Recovery

This is the final and most intensive stage of CRM work undertaken. The proposal for Phase 3 work spells out a management plan for cultural resources eligible for listing in the National Register of Historic Places that will be affected or destroyed by the planned development. It establishes suitable mitigation measures for the protection of the archaeological sites that minimize the impact of development or for excavation to recover data from sites that will be inevitably destroyed. **Mitigation** may include changing the design of a building so that it avoids archaeological resources, or the total excavation of sites, or portions of sites, that cannot be preserved with the aim of recovering as much information as possible. The final report on Phase 3 work, submitted to the appropriate government agency or contracting firm, describes and synthesizes the data recovered, providing a record of the archaeological resources studies.

Doing Archaeology The GE Mound Case, Indiana

There have been some successful prosecutions under the Archaeological Resources Protection Act (ARPA) of 1979. The 2,000-year-old GE (General Electric) Mound is a Middle Woodland Hopewell mound at the Mount Vernon site in southern Indiana (Munson et al., 1995). Artifacts from the mound came to light in 1988, during road-building operations for an adjacent construction project monitored by a

professional archaeologist. Subsequently, looters entered GE's property, digging and removing artifacts from the mound without the company's permission. Following anonymous tips, authorities established with scientific test excavation that looting had taken place. While GE installed fences and motion detectors on-site, the U.S. Department of Justice became involved when the chief of the Miami Nation of Indiana expressed concern that the looted artifacts might be sold in other states. One Indiana man was soon arrested and agreed to cooperate with authorities. Subsequently, many of the artifacts were recovered.

A two-and-a-half-year investigation led to the conviction of five men for ARPA violations. The ringleader, Arthur Gerber, a commercial photographer from Tell City, Indiana, pleaded guilty to three counts of purchase and transport of unlawfully removed artifacts from the GE Mound, of illegal transport, and of unlawful commercial sale. He plea-bargained a fine of \$5,000, a sentence of 12 months in prison on each count, and three years of supervised release during which he could not purchase, barter, or excavate archaeological resources or attend artifact shows. Two vehicles used in the looting were confiscated, and Gerber agreed to return all GE Mound artifacts in his possession. Four associates were convicted of lesser offenses.

The recovered artifacts included copper axes, breastplates and other artifacts, more than 2,000 bifaces, freshwater pearls, fragments of wooden and leather objects, and cloth. In court, Gerber and his supporting witnesses claimed they were doing "recovery archaeology," when, in fact, they were using shovels and picks to unearth very delicate, exceptionally well-preserved artifacts. The judge told the defendant he was "stealing history" and that he had been doing so for 25 years. Gerber's attorneys appealed the case as far as the U.S. Supreme Court, but the appeal was denied.

Once the case was closed, the artifacts were reburied, following intense controversy, which revealed widely differing perspectives on reburial and archaeological research practices among archaeologists. The GE Mound case unfolded against a background of shifts in public opinion toward protecting local sites against looters. But many collectors raised the issue of individual rights on private land, lobbying for changes in federal and state legislation. To some members of Indiana's Native American Council, the reburied artifacts were a

symbol to establish political power and personal prestige while promoting Native American beliefs in heritage rights and spiritual journeys (for discussion, see Munson et al., 1995).

The **compliance process** (often called the Section 106 process after the clause of that number in the National Historic Preservation Act of 1966) can be complex, involving the archaeologist in both recommending management strategies and conducting delicate negotiations with several government agencies at once. To be effective, a management plan should be regarded as a constantly evolving document, maintained and changed as archaeologists continue to manage and monitor the area. For example, Phase 3 excavation may reveal the presence of archaeological resources that were not identified in previous work, and consequently a new mitigation plan providing for additional research must be developed.

The same process involves both federal and state agencies in other management duties as well. They have the responsibility for protecting sites against vandalism, a major problem in some areas. The value of each individual resource must also be assessed, either on the basis of its scientific value established within the context of a research design or because it merits preservation in situ. Agencies must also consider how a site can be utilized for the public good. This responsibility means interpreting it for the public, who may either visit the location, as they do at, say, Chaco Canyon, or learn about it through books, television programs, and popular articles.

Management Versus Research

CRM for the most part involves gathering and assessing archaeological data from very specific areas dictated by development concerns, such as the site of an oil-drilling pad or the locations of pylons along a power line corridor. Often the areas covered may be small and encompass no cultural material or only portions of sites, but larger-scale projects can sometimes embrace entire regions or river drainages. The very nature of CRM work means a heavy emphasis on survey and limited excavation, on basically descriptive investigations aimed at satisfying compliance requirements. The identification and preservation of the archaeological record have sometimes been seen as the first and only priority of CRM

(Lipe, 1970). This is a relatively theory-free and descriptive approach in which management decisions about land use are based on a catalog of sites within an area. Until recently, most contracting agencies thought of archaeology as a discipline able to conduct piecemeal research. Sites or areas were selected by such criteria as imminence of destruction or availability of salvage funds. Agencies assumed that the results from each small project would somehow eventually become part of a grand, final synthesis.

Although such requirements may satisfy CRM guidelines, scholarly needs often most emphatically are not (King, 2012). The descriptive recording of archaeological sites, devoid of any synthesis, appeared to be at odds with the more anthropological archaeology that came into fashion in the 1960s and 1970s, with its emphasis on explicit research designs and explanatory objectives. Many academic archaeologists thought of the descriptive, salvage archaeology that characterized CRM as entirely inconsistent with the problem-oriented nature of research. As a result, there was a dangerous and often unthinking tendency to segment archaeology into two broad camps: academic researchers taking on specific problems on one side, and the contract archaeologists involved with salvage, management, and compliance on the other.

This insidious distinction is, of course, a gross simplification that fails to recognize the importance of CRM archaeology. CRM archaeology, especially when conducted on a large scale, offers unique opportunities for answering basic questions about the past. The challenge is to grasp these opportunities and to exploit them to the fullest. Any notion that academic archaeology is somewhat superior to CRM research at its best is arrogant nonsense. North American archaeology is CRM.

Today, there is constant feedback between emerging archaeological theory and methodology and the realities of contract work. Many CRM projects are redefining the way North American archaeologists go about their work, in part because of sound research designs and also because they are often funded at a far higher level than even the most ambitious academic projects—not only for survey and excavation but also for analysis and, sometimes, for publication (Whittlesey et al., 1998). A problem-oriented approach regards CRM as part of contemporary archaeology with all its sophisticated theoretical apparatus for studying and evaluating the past.

Some CRM projects have involved massive archaeological operations and the expenditure of millions of dollars in survey and excavation. The Ballona Wetlands project in Los Angeles, the Lower Verde Valley project in Arizona (Whittlesey et al., 1998), and the Black Mesa project in the Southwest (Gumerman, 1984) have all yielded important methodological contributions and, sometimes, major theoretical perceptions. CRM work on historic period sites has also involved some large-scale meticulous excavations that have greatly enhanced our understanding of the past (Joseph, 2002; Wheaton, 1990).

Some of the most successful of these projects have been conducted by large private companies that specialize in environmental impact work or by CRM archaeologists with close ties to academic institutions. For instance, researchers at the Institute of Archaeology and Anthropology at the University of South Carolina have developed a strong partnership with the university that allows them to carry out major CRM projects in an academic setting. With their excellent technical resources and large project budgets, they are able to conduct detailed research and fine-grained field and laboratory investigations that are beyond the budgetary scope of all but a few purely academic research projects.

As a long-term project, some scholars are pulling together enormous quantities of raw settlement data and other culture-historical information into detailed syntheses of the southeastern United States. Such efforts maximize the value of local CRM projects and bring the vast amounts of data they accumulate into a meaningful summary of great intellectual value (Anderson and Sassaman, 1996).

CRM archaeology is the only viable way to identify and document rapidly vanishing archaeological resources in North America, the very kinds of data required to fulfill one of archaeology's major objectives—the explanation of culture change over long periods. This is not only a matter of economic realities but also one of perceiving the opportunity to make major intellectual advances in archaeology while still meeting the requirements of individual contracts. Close collaboration with contractors is a major key to successful CRM work (see the Doing Archaeology box). Some CRM companies are beginning to work with large-scale land developers to complete surveys and mitigation recommendations years ahead of actual development of raw land. This

strategy has the advantage of allowing plenty of time to complete archaeological work far in advance of construction deadlines.

Doing Archaeology London's Crossrail Project

A classic example of the advantages of working closely with contractors comes from central London. More than 8 million people live and work in today's London, a huge metropolis crammed with busy streets, skyscrapers, and world-famous buildings like St. Paul's Cathedral and Buckingham Palace. London is an old city, dating back to Roman times 2,000 years ago, and with traces of scattered human occupation dating back to at least 9000 B.C. Saxons, Normans, Tudors, and their successors built and rebuilt on the ruins of their predecessors' architecture. So did the Victorians. The twentieth century witnessed orgies of construction, the Blitz of World War II, and a current building boom that includes the \$23-billion construction of a new 26-mile (41.8 km) line of the Underground subway system that bisects the very center of London. Archaeologists have worked alongside architects and construction workers using huge boring machines since the beginning of the Crossrail Project, which ranks as one of the largest, if not the largest, CRM project ever (Keily, 2017). Some of the tunnels were too small for boring machines and had to be dug by hand, with miners recovering artifacts as they dug, including in one case, a Roman cremation urn. Today's city lies atop over 30 feet (9.1 m) of archaeological deposits that have yielded millions of artifacts and the bones of thousands of ordinary Londoners from Roman times to the late nineteenth century, buried in cemeteries that were built over and forgotten (Figure 18.4a).

Excavations for the London headquarters of the Bloomberg financial group in the Cordwainer ward, home to leather workers since Roman times, uncovered entire streets of timber framed shops and houses, even fences and yards, all in a remarkable state of preservation in the wet soil of a small stream. Apart from coins and pewter plates, the excavators found 250 leather boots and sandals and nearly 400 writing tablets made of soft silver fir, recessed, and filled with a black wax. The scribes used a stylus (sharp pointer) to cut through the wax and expose the paler wood behind it that showed the script. Some of them some of them still displayed legible letters, financial documents and legal

agreements, even a contract for the sale of a slave girl. Nineteen tablets lay in a single room, perhaps legal documents. One of them may be a Roman officer's will dating to A.D. 67. The archaeologists believe this room was one of London's earliest offices (Symonds, 2016a).

Figure 18.4a Crossrail Project excavations.

Source: Courtesy of Amer Ghazzal/Alamy Stock Photo.

Another major dig in the foundations of an underground ticket hall for the Tottenham Court Road station, cut through the old Bedlam burial ground, London's first municipal cemetery. Most of the more than 3,300 people exhumed from the trenches dated to the sixteenth and seventeenth centuries, buried in Bedlam as churchyards filled rapidly with plague victims, a regular pestilence in the crowded city. About 30,000 people lie in the burial ground, many of them having perished in the great plague of 1665, which killed between 75,000 and 100,000 Londoners out of a total population of 450,000. Five skeletons crammed into one pit yielded the DNA of *Yersinia pestis*, the pathogen of bubonic plague, confirming historians' suspicion that this was the plague that slaughtered tens of thousands (Figure 18.4b). Bioarchaeologists are studying the skeletons, which come from every segment of London society, especially the working poor. Judging from another cemetery excavation at Charterhouse Square, many medieval inhabitants of the city suffered from malnutrition, one in six from rickets, to say nothing of injuries from backbreaking hard labor (Pfizenmaier, 2017). Yet London was a magnet. Isotope analysis tell us that over half of the fourteenth-century skeletons were of people who had traveled to London from as far away as Scotland.

Roman horseshoes, medieval ice skates made of bone, mysteriously decapitated skeletons, perhaps execution victims, even a Tudor bowling ball (King Henry VII's favorite game reserved for the wealthy)—a huge, eclectic mix of finds paints a picture of a vibrant, multicultural, but insanitary city that teemed with life, poverty, and fatal diseases. The archaeology extends right into the nineteenth century. The finds include 13,000 pickle and jam pots from the Crosse and Blackwell factory at Tottenham Court Road, some still with their original labels (Jeffries et al., 2016). The company's products reveal close ties with Indian markets,

endorsements by celebrity chefs, and a royal warrant from Queen Victoria. The factory closed in 1921.

Figure 18.4b Burials from the Bedlam burial ground.

Source: Courtesy of Alamy Stock Photo.

Strategies of CRM Research

With CRM being the dominant force in archaeological fieldwork in North America, the problem of ensuring quality research is of major concern. For all the debate about conflicting approaches, and, to be frank, a good deal of dubious research, CRM has brought extensive methodological benefits to basic research, among them a much greater emphasis on changing settlement patterns, sampling procedures, computer applications, and, above all, remote sensing. The major methodological contributions come in three areas: geomorphology, safety, and technology (Green and Doershuk, 1998).

Geomorphology

CRM projects have combined geomorphological expertise with four-dimensional views of landscapes (time being the fourth dimension) to better understand the development of ancient landscapes and for locating and evaluating deeply buried sites. For example, the Upper Mississippi Valley has experienced much sustained CRM work that combines studies of landscape change with paleoecology and buried site archaeology. The result: maps of Late Wisconsin and Holocene landforms for a 300-mile (480 km) stretch of the valley. This is a superb basis for accurate assessment of cultural resource potential (Bettis et al., 1996). A similar approach has been used by researchers with the Cultural Resource program at Fort Drum, New York. In the past, much of the military base had been covered by Glacial Lake Iroquois, which gradually receded over the past 10,000 years. Mapping of fossil beaches has allowed archaeologists to model occupation from Paleo-Indian times, through the Archaic and Woodland periods.

Safety

Whatever their fieldwork, archaeologists face special safety issues, and CRM researchers have taken the lead in introducing high safety standards to the field, which has brought archaeology more in line with guidelines in other fields such as construction, engineering, and drilling. Occupational Safety and Health Administration (OSHA) regulations and various local laws may be relevant to archaeological fieldwork. For example, with the need to determine the presence of archaeological resources in areas with thick soil deposits, and an increasing number of geomorphological studies, comes deeper trenching. Excavation units extending more than 4–5 feet (1.2–1.5 m) deep must be shored up to ensure the safety of workers. In some instances, archaeologists have to evaluate sites that may be polluted by toxic waste, and fieldworkers have to wear protective clothing.

Technology

CRM archaeologists lead their colleagues in applications of high-technology remote-sensing devices, computer-based data collection, and data management systems. Because of the often pressing need to quickly identify and excavate sites, CRM projects often employ ground-penetrating radar, magnetometers, and resistivity surveys to locate sites and features without time-consuming excavation. Problems of data storage and the dissemination of information, faced by all archaeologists, are made especially pressing by the volume of CRM work. CRM archaeologists have led the way in the innovative use of computer databases and data management programs to address these concerns (see the Management Challenges section). Geographic information systems (GIS) have also played a leading role in many CRM projects, as does the technology of site protection.

To these innovations may be added a diversity of other developments that have largely emerged within the context of CRM research. Some truly remarkable investigations combine these and other innovations under often severe all-weather conditions. For example, a CRM project on a Civil War-era foundry in New York State was undertaken under heated domes, with heaters operating 24 hours a day. The research combined remote-sensing techniques with computer transit mapping, image analysis, and three-dimensional photogrammetry. The field

conservation and curation facility processed as many as 5,000 artifacts a week, each being washed, X-rayed, computer inventoried, decontaminated where appropriate, and conserved. All this activity was carried out under OSHA and Environmental Protection Agency (EPA) hazardous materials procedures and precautions, then combined with documentary evidence to provide a story of intelligence operations that were carried out under President Lincoln's direct authority (Grossman, 1994).

Management Challenges

Although CRM has transformed American archaeology—for the most part, for the better—it has also brought its own set of problems. While these difficulties to a large extent are problems faced by all archaeologists, some are particularly challenging because of the sheer volume of CRM work undertaken.

Issues of Quality

Some of the most pressing problems concern the quality of the archaeological research. Although federal legislation spells out guidelines, their implementation varies in different states and community settings. State historic preservation offices (SHPOs) and tribal historic preservation officers (THPOs), the state and tribal mechanisms mandated by the National Historic Preservation Act to oversee CRM work, are often understaffed, and many find it difficult to keep up with oversight. The amount of activity is so great that the only long-term solution to the crisis of quality lies in the increasing integration of the goals and research techniques of scientific archaeology, on the one hand, and the realities and demands of cultural management and contract archaeology, on the other.

Attempts have been made at self-regulation. Most professional societies that archaeologists belong to now have statements on ethics and guidelines for archaeological research. Organizations such as the Register of Professional Archaeologists (www.rpanet.org) and the American Cultural Resources Association (www.acra-crm.org) have stringent guidelines for research, as well as for archaeologists'

responsibilities to the public, clients, and fellow archaeologists. If adhered to, these would ensure uniformly high standards of behavior and research. Unfortunately, the value of the guidelines is only as good as the organizations' memberships, which are entirely voluntary. Rather like the Better Business Bureau, enforcement of ethics is difficult and censure limited. Regrettably, a few archaeologists have, in fact, seen membership in organizations like the RPA as a substitute for graduate training in archaeology.

The Issue of Site Records

Some of the other basic problems are in some respects easily remedied, but the solutions lie in financial and resource investments that are too often lacking. In particular, the accessibility of CRM data for planning, the curation of archaeological materials, and the dissemination and recording of information are a concern.

The recording of archaeological data is especially important, as the study of community and archaeological site distributions is integral to effective CRM. Only when sites are identified and the information is provided to development planners can sites be protected or salvage work undertaken. The collection and organization of these data can, however, be challenging. Information on archaeological sites within a region is often obtained from a variety of sources that may vary tremendously in terms of detail and quality and be scattered in a diversity of different reports, archives, and publications. For example, information on academic projects and archaeological work by amateurs may not be located in the same repositories as CRM reports.

Fortunately, computerized databases and electronic media such as CD-ROMs and the Web hold great potential for the future. In order to address management concerns in central New York, Douglas Armstrong, LouAnn Wurst, and Elizabeth Kellar created a unified regional archaeological site file (Armstrong et al., 2000). The Syracuse University Intermodal Systems Transportation Enhancement Act (ISTEA) project was sponsored by the New York State Office of Parks, Recreation, and Historic Preservation, which saw the task as a necessary prerequisite for effective regional planning. A central part of the research was the development of a GIS program that allowed

information on archaeological and historic resources from a wide variety of sources to be incorporated and overlaid on maps of the study area. The result was a comprehensive tool for development planning.

The information collected by Armstrong and his colleagues included Native American and historic sites identified by academic research projects, CRM studies, and work by amateur archaeologists, as well as National Register Historic Properties, local landmarks, Historic Markers, Native American trails, and historic data (see [Figure 18.5](#)). GIS allows the distribution of cultural resources to be sorted and graphically displayed by source, time period, cultural association, or activity area represented, providing an immediate assessment of cultural resources within a particular area.

[Figure 18.5 Reconstructed 15th century Iroquoian longhouse built for the Wold Cal people in Crawford Lake Conservation Area, Ontario, Canada.](#)

Source: Charlene Xia Ontario Canada Collection/Alamy Stock Photo.

The Syracuse University ISTEa project was primarily intended to address CRM concerns—to protect archaeological and historical sites from destruction. But the data obtained can be used to address a diversity of research issues. One of the things revealed by the project was the gaps in coverage, in terms of time periods, areas, and types of sites recorded. For example, the study revealed that historic period domestic sites in both town and rural areas were virtually overlooked in archaeological surveys. This type of information is useful to archaeologists, as well as planners, in evaluating the importance of sites. The Digital Archaeological Record (tDAR) is an international digital archive and repository that houses a wide range of archaeological data and will become an important tool for all kinds of archaeological research in the future. See www.tdar.org/.

[The Issue of Curation and Collections Management](#)

Curation is the management, storage, and conservation of artifacts and other data recovered in the course of archaeological activities. **Collections management** is the long-term care of archaeological collections in perpetuity, the logical follow-on from curation. Archaeology has always been an area of intensive research. Once

artifacts from a site have been excavated and analyzed, what happens to them? Archaeological surface collections and excavations can easily amass hundreds of thousands of artifacts, many of which require conservation if they are to be preserved. Whereas in the past artifacts were sometimes discarded after analysis, keeping the collections for future study or additional analysis is clearly desirable: Material from previous studies may be reexamined as part of new projects, and new methods of analysis may yield information undreamed of by the original excavators.

Many archaeological organizations and institutions have established guidelines for the curation and management of materials. The National Park Service, for example, has issued regulations for the curation of federal collections, as required under amendments to existing legislation. Unfortunately, curation and management are expensive, and the costs of providing permanent conservation and storage can be prohibitive. Many museums and other designated repositories are grappling with seemingly insurmountable mountains of archaeological finds that pour in from CRM projects. Aside from the space they occupy, the finds must be labeled, cataloged, and placed in plastic bags or boxes that will neither disintegrate nor damage poorly preserved materials. The conservation—cleaning, stabilizing, and preserving—of deteriorating artifacts is a huge problem with some artifacts such as ancient baskets or metal objects that will disintegrate unless properly treated.

Curation is an easily surmountable problem—given time and resources. Archaeologists and museum technicians know what needs to be done, but realization is another issue. Efforts to inventory and curate collections have led to improved guidelines and new facilities. However, there is simply not enough space to house many collections, and there are not enough funds to pay the real costs of curation. Consequently, curation and collections management will likely be an issue of continuing concern. Many future jobs in archaeology will be in these areas. There's an invaluable National Park Service course on the archaeological curation crisis: www.nps.gov/archeology/collections/index.htm.

The Issue of Publication and Dissemination

Proliferating contract archaeology and CRM work have caused an explosion not only of raw data but also of publications and reports on completed projects. The essence of publishing archaeological data is, of course, to make them available to as wide an audience of archaeologists as can make use of them. This distribution is achieved through books, national and international journals, and regional periodicals such as the *Plains Anthropologist* or the *New Hampshire Archeologist*. Many of these are widely distributed, peer-reviewed publications, where the submitted contributions are read, evaluated, and edited prior to publication. Ideally, this type of process would be used for all CRM reports and the results of important projects published, but this is clearly impracticable.

Reports on many smaller projects are often purely descriptive and incorporate limited synthesis of data outside of the narrow scope of the project. Although some such reports are potentially useful, many more are sterile, rote descriptions that add little to our understanding of the past and are solely designed to meet CRM legislation. Many of them are literally archaeology by formula, as if the investigators are filling in a form. Even reports on important studies do not receive the degree of external, editorial peer review found in academic journals. This is one reason that archaeologists such as Ian Hodder (1999) have insisted on the vital importance of a marriage between theory and excavation, which is not merely a sterile recording process.

Another problem lies with the availability of CRM reports. Even many excellent CRM reports are either restricted-circulation documents deeply buried in the files of government agencies or private companies or, at best, photocopied publications that have a severely limited circulation—the so-called gray literature. There were about 250,000 gray literature reports in existence in the early 2000s, with an additional 10,000–20,000 reports accruing annually. The number has proliferated since then. Sometimes, within months they are forgotten, even destroyed, and the vital data in them are as good as lost to science. The problem of failure to publish CRM data in more widely accessible forums is enormous. Ironically, now that awareness about destruction of the archaeological record is greater than ever, the results of much of this anxiety are being buried, almost as effectively as if they had been destroyed, in inaccessible publications. The advent of the internet has

helped ease the situation somewhat, but there are issues of permanence to be considered with websites. The archaeological record is finite, which means that *permanent* records of its excavation must be the exact opposite. The issue of publication and dissemination remains a critical one for the archaeology of the future.

Public Involvement and Public Archaeology

One of the most important benefits of CRM has been the increasing input from the public into archaeological research. This is important because it is ultimately the greater public who should benefit from CRM research and it is the public who ultimately funds the research undertaken. There are many stakeholders in the past, not only archaeologists, but among them landowners, communities, indigenous populations, and the general public. Many voices have potential input into what archaeologists do: There are many publics (Little and Zimmerman, 2010; Skeates and McDavid, 2012).

Although expenditures on contract archaeology may no longer be at the levels of the late 1970s, arguments rage about the worth of even a tenth of such expenditure. Though one can argue that knowledge in itself is valuable and is worth spending money on, one must show something for the money beyond an abundance of technical and often inaccessible reports. CRM legislation identifies sites and provides a basis for management decisions about cultural resources, but do these designations mesh with public perceptions? Archaeologists may wax lyrical about the scientific significance of a small hunting site or a nineteenth-century farmstead, but the public is often much more interested in visually striking sites with humanistic significance.

A great deal of the effectiveness in protecting archaeological sites depends on public attitudes toward the past. Cultural and adventure tourism are of growing importance, and many sites are also significant expressions of national identity. Diminutive Fort Necessity in Pennsylvania would likely have received far less attention from archaeologists and tourists alike had it not been hastily constructed in 1754 by a young lieutenant colonel named George Washington (Harrington, 1977). Gettysburg has a supreme place in our national heritage, as does Mesa Verde. Both are visited by tens of thousands of

people each year.

The basic question is easily stated: Is the public benefiting in practical ways from the expenditure of enormous funds on archaeology? Many people think of archaeology as a luxury and wonder how much taxpayer money is spent on CRM. They are ambivalent about protecting the past, let alone spending money on it. Yet thousands of other interested citizens have joined amateur archaeological societies in many parts of the country. In response to both of these opinions, archaeologists have increasingly tried to share the importance of CRM with the wide public and other stakeholders. What is sometimes called community archaeology marks efforts to involve stakeholders in the dynamic past of their surroundings.

Education and Archaeology

In recent years, to draw public attention to CRM concerns, considerable effort has gone into informing the public about archaeology, to the point that many archaeologists now talk of **public archaeology**, a form of archaeology open and accessible to the public through television, state-sponsored “archaeology weeks,” special museum displays and activities, and the Internet (Merriman, 2004). Many archaeological societies and museums have workshops and activities aimed at schoolchildren and the wider public. This new outward-looking perspective is vital to the future conservation and preservation of the world’s archaeological heritage.

But there is still a long way to go. Although such agencies as the Bureau of Land Management are now expending significant resources on public education, most CRM work has had little effect on public involvement in archaeology. A few projects provide excellent examples of how to reach a wider audience. In areas such as historic Alexandria, Virginia, and Annapolis, Maryland, archaeologists have worked closely with historians and the local communities to provide walking tours, lectures, and other educational programs that share archaeological discoveries and management concerns with visitors.

Native Americans and CRM

More and more research designs in American archaeology are taking account of Native American attitudes toward the proposed work. Most archaeological research in the Americas has involved the excavation of Native American sites, though the majority of the researchers have been of non-native ancestry. Generations of archaeologists have assumed that the knowledge obtained from their research is of benefit to all, including indigenous peoples. CRM concerns about the protection and management of archaeological sites would also seem to place Native Americans and archaeologists on the same side. Despite these presumed common interests, Native American views about what sites should be preserved, how archaeological research should be conducted, and the ways in which archaeological remains should be treated are often dramatically different from those of archaeologists (Watkins, 2001). These approaches are sometime labeled **indigenous archaeology**.

Major controversies surround ritual sites and artifacts, also burials. While we archaeologists see such items as important clues to past religious beliefs, social organization, and health, many native groups view our excavation as sacrilegious and disrespectful of their cultural heritage. Such was the case when local Native Americans insisted that the Chimney Rock Mesa skeletons in Colorado, disturbed by vandals, be reburied. Local archaeologists wanted to conserve and study the human remains, but they were overruled by the federal land manager on legal grounds.

Most archaeologists have thought of themselves as objective observers of the past or as favorably inclined toward Native Americans. But as Bruce Trigger pointed out long ago (1985), many archaeologists have been influenced by popular stereotypes of indigenous peoples. Only recently have they become aware of the social significance of their studies. They have also come to realize that archaeology can no longer be undertaken independently of society. Ethics statements by professional organizations now include statements concerning the rights of indigenous peoples and the need to consider Native American concerns in archaeological research.

The inclusion of Native American rights in CRM decisions is mandated by a number of federal laws. The American Indian Religious Freedom Act of 1978 guarantees access to sacred sites, requires federal

agencies to adjust management policies to reflect its provisions, and recognizes the existence of sacred sites (King, 2012).

This legislation and the Native American Grave Protection and Repatriation Act of 1990 (discussed later) have profoundly affected U.S. archaeology, for it often involves consulting with tribal and religious leaders if religious sites are to be disturbed. It has given Native Americans considerable say in the conduct of CRM on public lands, and they have reacted strongly to development projects on sacred, privately owned lands as well. Some groups, such as the Hopi, Navajo, and Zuni of the Southwest, are now working closely with archaeologists, using their own archaeological units (see the following discussion; see also Anyon and Ferguson, 1995; Carmean, 2003).

Repatriation

By far the most serious area of disagreement between Native Americans and archaeologists revolves around the treatment of skeletal remains. Often encountered in excavations, they are the focus of a great deal of study by both archaeologists and biological anthropologists. Many Indian communities are incensed by the excavation of burials and have pushed for laws forbidding such activity and compelling reburial or repatriation of excavated skeletons. Their activist policies, and a growing public awareness of the complex issues involved, led to passage of the Native American Grave Protection and Repatriation Act of 1990 (NAGPRA) (Thomas, 2000). American archaeology has changed profoundly since its enactment (Wilcox, 2010).

The 1990 act establishes two main requirements. First, all federal agencies and museums receiving federal funds are required to inventory their holdings of Native American human remains and associated funerary objects. They must also develop written summaries for funerary objects not found in graves, sacred objects, and what are called “objects of cultural patrimony” that are in the collections they control. This inventorying process, which will take years to complete, also requires that agencies and museums establish, as best they can, whether their individual holdings have any cultural affiliation, or, in the case of skeletons, lineal descendants in living Native American groups. If they do establish a relationship, then they are required to

notify the relevant Native American organization about the existence of the materials and offer to repatriate them. Even if they have no cultural affiliation with museum holdings, or disagree with the museum's identifications, a group can still request repatriation.

The second requirement protects all Native American graves and other cultural objects found within archaeological sites on federal and tribal lands. This requirement encourages the in situ preservation of archaeological sites, or at least those parts of them that contain graves. It also requires anyone carrying out archaeological investigation on federal and tribal lands to consult with affiliated or potentially affiliated Native Americans concerning the treatment and disposition of any finds, whether made during formal investigations or by accident. The Repatriation Act also stipulated that illegal trafficking in human remains or cultural objects may result in criminal penalties, authorized the secretary of the interior to set up a grant program to assist museums and Native American tribes in complying with the law, and authorized the development of regulations to administer the provisions of the act in consultation with a national review committee.

The NAGPRA mandates a level of consultation and concern for Native American rights that is far greater than had previously been the norm in the United States. The signing of the act came after years of controversy that pitted—and still pits—Native Americans against scientists. The archaeologists and anthropologists point out that revolutionary new research techniques are beginning to yield a mine of information about ancient North Americans. To rebury the database for such research deprives science, and future generations of Americans, of a vital resource, they argue. Others, including some archaeologists, respond that this is an ethical and moral issue, and that such considerations outweigh any potential scientific gains. Many museums, universities, and other institutions have adopted repatriation policies, and the Society for American Archaeology and other professional organizations have drafted ethical statements on the problem—not that these efforts have dampened emotions on either side of the issue. There remain many contentious questions. Can skeletal materials and artifacts analyzed by archaeologists provide evidence for links between Native American groups and their more remote ancestors? Do changes in artifacts, in material culture signify cultural continuity or the arrival of

new groups? Can modern ethnic classifications be projected back into the past? All these questions are part from other fundamental questions. Can, for example, archaeologists, predominantly Anglo-Americans, define the parameters of Native American culture (Wilcox, 2009)?

There will be no quick resolution of NAGPRA issues, however promptly and sensitively archaeologists and their institutions respond to Native American concerns and comply with the provisions of the 1990 act. Many of the issues are inchoate, of great moral importance and sensitivity, and address basic questions about the morality of all archaeological research. Only one thing is certain; no archaeologist in North America, and probably elsewhere, will be able to excavate a burial, whatever its age, without the most careful and sensitive preparation. This involves working closely with native peoples in ways that archaeologists have not imagined until recently. Nothing but good can come of this, indeed the level of consultation has improved dramatically in recent years, led by government officials, museum officers, and many CRM archaeologists, this despite strong disagreements among archaeologists themselves. There are still those who believe they are unique stewards of the past. Fortunately, most practitioners disagree with them. As a result, North American archaeology has become less insular and more responsive to a wider constituency of stakeholders. Today's archaeological projects now routinely begin with discussions with tribal councils and other Native American representatives, with local communities and other stakeholders (Colwell-Chanthaphonh and Ferguson, 2008; Ferguson and Colwell-Chanthaphonh, 2006).

The repatriation issue has international overtones, for indigenous groups outside North America, notably the Australian Aborigines, have striven for strict control of burial excavations. Increasingly, archaeologists and native peoples are working together to hammer out long-term agreements, or at least statements of principle, to cover repatriation and burial excavation. On the international front, the executive committee of the World Archaeological Congress has adopted an accord that calls on archaeologists to be sensitive to the concerns of indigenous peoples. Named the Vermillion Accord after the town of Vermillion, South Dakota, where it was drafted in 1989, the statement

calls for respect both for the dead and for the wishes of their descendants, as well as for the scientific research value of human remains. It establishes the principle that agreement on the disposition of human remains be established on the basis of mutual respect between the legitimate concerns for the correct burial of ancestors and the concerns of science and education.

Working Together: The Hopi of the Southwest

The Hopi tribe's Cultural Preservation Office has used existing historic preservation legislation as a way of ensuring input on management decisions about archaeological sites on their reservations and in adjacent areas. Their tribe-funded organization includes a tribal archaeologist, project archaeologists, a transcriber, and Hopi research specialists. Its mandate is to preserve the "spiritual and cultural essence of the Hopi, encompassing ... archaeology, ethnology, recovery of stolen sacred artifacts, farming, and the preservation of the Hopi language" (Ferguson et al., 1995). The Cultural Preservation Office is developing appropriate ways for villages, clans, and religious societies to participate in ongoing research activities. Since clan histories are ritual knowledge, rarely shared with members of other clans let alone with non-Indians, involvement of Hopi elders, the guardians of sacred knowledge, is vital.

The Cultural Preservation Office works closely with an advisory group of representatives from each Hopi community, from clans, priesthoods, and religious societies—people who possess vital information for the management of cultural resources. The consultation process is time-consuming but essential to overcome the suspicions many Hopi have of archaeologists and other Western scientists. The Hopi have stated that their participation in the compliance process does not mean that they endorse a specific project or development. They will never condone the destruction of a site, but they will recommend mitigation through scientific study, on the grounds that a written report of an ancient site is better than no record at all, so that the memory is not lost forever.

The Hopi definition of a site worth preserving is far more wide-reaching than found in federal and state legislation. In legal terms, they,

and other Native American groups, define every ancestral archaeological site as a traditional cultural property to be protected and left alone. The same term, *traditional cultural places*, is applied to shrines, sacred sites, springs, quarries, and ancient landforms with place names commemorating historic events—some of which bear no visible traces of human activity. Thus, archaeological sites play a central role in the transmission and retention of Hopi culture.

In practical terms, this broad definition, which many archaeologists now accept, raises interesting problems. For example, the Hopi want sites registered in the state archaeological databases, but they want to keep the locations of certain cultural properties secret. Both the archaeologists and the Hopi are working to develop accurate ways of defining sites while respecting these concerns.

Many Native Americans are interested in preserving sites, but they are not interested in archaeology as such. The Hopi, however, are interested in archaeology, in how archaeologists collect data, and in how the data are analyzed. Some elders want to compare archaeological findings with their own system of knowledge. Ferguson and his colleagues (1995) pointed out that agreement between archaeological and traditional data is often explained in the context of Hopi ritual knowledge. For instance, Hopi prophecies of a time when even the ash left by the ancestors will be used to prove their claims have been connected to the flotation methods used to dissect ancient hearths.

Hopi standards of what constitutes legitimate research are evolving, as all parties become more familiar with one another and as archaeology itself evolves. At the same time, tribal members may feel a new need to acquire information about their past, because they do not want to lose their identity as Hopi.

Collaboration between indigenous peoples and archaeologists involves far more than management and mitigation. It involves profound respect and sensitivity toward the values and expectations of others in the interests of the long-term public good.

Cultural Resource Management Around the World

This chapter has dealt primarily with CRM in the United States, but the preservation of the past and the protection of cultural resources are of

worldwide concern (Layton, 1989; Schmidt and McIntosh, 1996). The threat of unchecked development and the looting of archaeological sites for antiquities are worries that plague other countries as well.

Many archaeological sites and cultural resources face imminent destruction as national governments try to balance the need for development with concern about their pasts. The problem is especially pressing in developing countries. The independence of many former colonies in the 1950s and 1960s resulted in substantial investment and economic aid, and the emergence of development as a dominant theme. Yet the interrelated consequences of increasing construction, urbanization, and resource exploitation became a source of worry. While development brought needed improvements, it also created further threat to the archaeological past. The consequences of economic development have often included widespread devastation of large tracts of hitherto undisturbed natural and historical landscapes.

In an increasingly interconnected and multicultural world, affluent adventure tourism is often viewed as a desirable source of foreign income. Archaeological sites have emerged as major money earners in the United States, Europe, Asia, South America, and Mesoamerica (see [Chapter 19](#)). But this source of wealth has also increased both the threat of development and the intentional looting of archaeological sites for salable antiquities. This aspect of economic development has drawn the international community's attention to the preservation and marketing of archaeological resources. The development pressures of the 1960s, followed by the environmental movement in the 1970s, led many countries to pass legislation replacing the outdated, ineffectual statutes of a less stressful pre-World War II era.

These new laws gave birth to CRM (Hutt et al., 1993). The establishment of the United Nations Environmental Program (UNEP) in 1972 provided funding to mitigate the impact of development. In 1988, the United Nations Educational, Scientific and Cultural Organization (UNESCO) launched the "World Decade for Cultural Development" (Serageldin and Taboroff, 1994). It stressed the need to recognize the cultural dimension of development. Individual nations have taken varied steps toward improved management practices—for examples of legislation and implementation, see McIntosh (1994) and Schmidt (1996b). This concern of the international community is a result of the

awareness that the archaeological heritage is a major, vulnerable, and nonrenewable resource.

Unfortunately, concern has arisen because heritage legislation in most countries permits the private ownership of archaeological resources, which makes it challenging to safeguard them from development. In developing countries, the problem is made worse by the lack of trained personnel and inadequate funding to identify and evaluate antiquities and effectively manage cultural heritage. The plight of Africa's past, highlighted in a number of publications, illustrates the severity of the situation in many world areas. Attention has focused on the looting of archaeological sites for the antiquities trade, issues of cultural patrimony, historic preservation, and archaeological resource management—major concerns worldwide. Governments have far to go to safeguard the record of the past.

All archaeologists are managers of a finite resource that is banked in various ways—in the ground, within the pages of a report, or by finds and records in a museum storeroom. We have two alternatives for the future: either collect and interpret information about our cultural resources in a useful manner as an activity that contributes to the public good, or take the easy way out and abandon the archaeological record to extinction.

Summary

1. CRM involves the development of overall strategies for conservation priorities and management of a finite resource, the archaeological record.
2. The 1960s saw the development of the concept of CRM. In the United States, new federal legislation, notably the National Historic Preservation Act of 1966, the National Environmental Protection Act of 1969, and the Archaeological Resources Protection Act of 1979, laid down regulations for land use and resource policies and also defined archaeological resources as any artifact more than a century old.
3. Federal legislation, in combination with many state, local, and tribal laws, provides the legal means of identifying the country's

archaeological heritage. Some of the best protected archaeological sites in the United States are in national and state parks, forests, reservoirs, and military reservations, where management plans require the identification of archaeological resources. The biggest gaps in the protection of archaeological resources in the United States are on private lands.

4. The primary concern of CRM archaeology has been the identification, description, and avoidance or recovery of archaeological resources. Many CRM projects are small scale and the reports are descriptive. However, larger scale projects often provide opportunities for major archaeological excavations and surveys that have important bearing on the development of archaeological method and theory. CRM is having an increasingly important impact on the future direction of American archaeology, on account of both its large budgets and its unique opportunities for large-scale field and laboratory research.
5. The sheer volume of CRM research has led to problems. In some cases inadequate oversight has allowed inadequate archaeological research to be accepted. The recording of sites, the curation and storage of artifacts, and the publication and dissemination of important discoveries are also issues that need to be addressed.
6. One of the most important benefits of CRM has been the increasing input from the public into archaeological research. This is important because it is ultimately the greater public who should benefit from CRM research, and it is the public who ultimately funds the research undertaken. To inform the public about archaeology, many archaeologists now talk of public archaeology, a form of archaeology open and accessible to the public through television, state-sponsored "archaeology weeks," special museum displays and activities, and the Internet.
7. Native American concerns figure increasingly strongly in North American archaeology. Native American groups have demanded that many Indian skeletons in public and private collections be returned to them, a movement that culminated in the passing of the NAGPRA of 1990. This legislation protects Native American

graves on federal and tribal lands, requires museums and government agencies to inventory their holdings, and provides for the repatriation of remains with direct affiliations with living groups.

8. Archaeologists are working more closely with Native American communities when excavating sites where burials are likely to be found.
9. CRM and the destruction of archaeological resources are of global concern. The threat of unchecked development and the looting of archaeological sites for antiquities are worries that plague other countries as well. The problem is especially pressing in developing countries, where the consequences of economic development have often included widespread devastation of large tracts of hitherto undisturbed natural and historical landscapes.

Further Reading

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Merriman, Nick, ed. 2004. *Public Archaeology*. Abingdon, UK: Routledge.

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19

Archaeology and Contemporary Society

CHAPTER OUTLINE

Archaeology and Human Diversity
Archaeology and Human History
Archaeological Tourism
Archaeology and Subsistence Agriculture
Garbology
Archaeology and the Environment
Heritage and Stewardship

Archaeology as popular culture: The pyramid shaped Luxor Hotel, Las Vegas, Nevada, designed throughout with an Ancient Egyptian theme.

Source: Courtesy of Marc Dozier/Superstock.

A century ago, the archaeologist was an eccentric curiosity, someone who traveled to distant lands to dig ancient cities and discover lost civilizations. There were a mere handful of professional archaeologists in those days, many of them from wealthy families with private incomes to match. There were exceptions, of course, like the legendary Egyptologist Flinders Petrie, who was of humble birth and was famous for the austerity of his field camps, where one ate out of used tin cans. Howard Carter of Tutankhamun fame was an impoverished artist. In the Britain of his day, he was outside of archaeology's snobbish circles, where birth, schooling, and money gave access to what was a cliquish world of scholars and sometimes gifted excavators who were notorious for their backbiting and gossip. In those days there was little or no professional training, just hands-on apprenticeships, almost always without pay. Archaeology was a leisurely pursuit 100 years ago, almost a self-indulgence for the affluent and adventurous. As we have seen, the archaeologist was thought of as a romantic, often swashbuckling figure, a grossly misleading stereotype that lingers to this day, thanks to Hollywood's Indiana Jones and Lara Croft movies.

Today's archaeology is far from eccentric, firmly based in science, and has become part of the central fabric of contemporary society. It is a respected science, as familiar on television news and in newspapers as fires and automobile accidents. A major archaeological find, like the original Jamestown settlement (see [Figure 1.11](#) on page 22) or the Grotte de Chauvet rock paintings (see [Figure 17.3](#) on page 347), makes international headlines, and with good reason. More people are fascinated by the remote past and by archaeology than ever before. The archaeologist with his or her hardhat, global positioning system (GPS), and trowel has become a commonplace. We're no longer seen as strange or elitist. We're part of popular culture, even if stereotypes of cave people with clubs and of buried treasure persist (Holtorf, 2006). This chapter takes a closer look at archaeology in contemporary society.

Archaeology and Human Diversity

As we have seen, archaeology is a unique way of studying ancient human societies, because it is the only science capable of examining the ways in which such societies have changed over long periods of time.

Archaeology deals in days, decades, centuries, millennia, and even millions of years. No other science looks at humanity from such a perspective, in a world where written records extend back a mere 5,000 years or so in Egypt and Mesopotamia, and over much shorter periods elsewhere (Kelly, 2016). In some places, like the Amazon, written history dates to but the past 50 years or less.

Archaeology is the only tool we have for studying the whole range of human biological and cultural diversity, from our origins in tropical Africa over 3 million years ago up to recent times. Let's stress the word "diversity," for humanity has displayed remarkable similarities and diversities ever since *Homo sapiens* emerged in Africa more than 300,000 years ago, and certainly well before that. Some years ago, the Harvard biologist Stephen J. Gould remarked memorably that all living humans were products of the same African twig, and a young one at that. His comment raises a fundamental question: How are we different and how are we similar? Even today, in our closely interconnected world, we have a startling ignorance of the ways we differ from one another, and the ways in which we share a common humanity. Archaeology, together with molecular biology on the biological side, offers unique insights into our diversity and similarity. This is one fundamental reason why scientists who apparently spend their time studying garbage heaps and graves have become an essential part of today's world.

Archaeology and Human History

Westerners look back at history in a linear fashion, which is why many archaeologists are preoccupied with chronology. As we saw in [Chapters 2 and 3](#), we've come a long way from the ladder-like evolutionary schemes of the Victorian anthropologist Edward Tylor and others. Our perceptions of the past have become infinitely more complex. Today, we know that by no means did all societies progress on a cultural trajectory from simpler to more complex, or even through the same technological stages, such as Neolithic, Bronze, and Iron Ages. The human past may have been chronologically linear, but it was a great deal more complex than our scholarly forebears imagined.

We are the only scientists who reconstruct history from the material

remains of human societies, usually without the assistance of written records. This means that we are capable of writing the histories of many preliterate societies that only recently adopted writing. Instead of documents, we use artifacts, structures, food remains, and the surviving remains of human behavior. Archaeologists are as much anthropologists and historians as those who study historical and living societies. We just happen to do so with artifacts, conspicuous and inconspicuous, with all the detritus of life in the past (see the Discovery box on page 386).

In the 1940s, archaeologist Vere Gordon Childe (1942) wrote a series of popular books in which he described the origins of food production and civilization in southwestern Asia, and the development of European society. In these memorable volumes, he wrote the story of European prehistory using artifacts and archaeological cultures as the characters in his story. All modern efforts to tell stories about the past owe much to Childe's work. Between the 1940s and 1960s, the notion of global prehistory came to the fore, driven in part by the development of radiocarbon dating, which culminated in the publication of Grahame Clark's *World Prehistory* in 1963. Today, archaeology is a truly global enterprise, carried out in virtually every country in the world. Whereas earlier there were a few hundred of us, now there are thousands.

World prehistory is, in the final analysis, a history of humankind in all parts of the world written from artifacts and other material remains rather than from documents. Up to about 100,000 years ago, the issues in human history came down to us as a huge global story—migrations of humans out of Africa, the origins and spread of *Homo sapiens*, and so on. It was only during the late Ice Age, certainly after around 75,000 years before present, that human history became more local, at a time when our anatomically modern predecessors developed all kinds of more specialized adaptations to a wide variety of climates. These local adaptations accelerated when post-Ice Age global warming began about 15,000 years ago as human societies became ever more complex and diverse. So, in a sense, one can talk of the human past before the development of writing, cities, and civilization some 5,000 years ago in terms of two broad chapters. Before about 100,000 years ago, the record is generalized, and one tends to think in terms of broader issues, such as the first human settlement of Europe. After that, the focus of human

prehistory narrows, and archaeologists, while still studying such issues as the first settlement of the Americas or the beginnings of farming, tend to focus their research, and their studies of the human past, more locally. This is one reason why there are so many specialists in the archaeological world.

DISCOVERY Assyrian Queens at Nimrud, Iraq

In 1951, British archaeologist Max Mallowan excavated a room in the royal living quarters of the Northwest Palace in the Assyrian city of Nimrud on the Tigris River in northern Iraq. There, he unearthed a bath-shaped coffin containing a richly adorned woman. Nearly 30 years later, Iraqi archaeologists Muayyad Damerji, Donny George, and Muzahim Mahmud Hussein carried out further excavations in the same area (Oates and Oates, 2002). While doing so, Hussein noticed an uneven floor in one of the palace rooms. He examined the surface closely and found a shaft that led to a flight of stairs and a vaulted, earth-filled chamber, whose ridge had caused the unevenness in the floor overhead. A sarcophagus at the far end of the chamber contained the skeleton of a woman aged 50–55. She wore fine gold earrings, gold beads that had once formed several necklaces, and an array of gold bracelets, five on her left forearm alone. These were some of the few known examples of Assyrian jewelry, for the Medes and Babylonians had sacked Nimrud thoroughly in 612 B.C.

The following year, Hussein observed another inconspicuous ridge to the side of a courtyard. Another meticulous search eventually located the entrance to a more elaborate tomb that led down some steps into a small antechamber. Two huge doors opened into the main burial chamber, with a stone sarcophagus at the end. This time the tomb was waterproof and free of the earth that had seeped into the previous year's sepulcher. Everything was exactly as it was when the chambers were sealed.

A niche in the antechamber wall held a clay tablet, which identified the owner of the tomb as Queen Yaba, the wife of Assyrian king Tiglath-Pileser III (744–727 B.C.). Someone had violated the tomb soon after the royal funeral. The sarcophagus contained not one but two women. Queen Yaba was probably the lower body; the later one had been cooked to a temperature of 100–200°C before burial. Conceivably,

she had died elsewhere and been heated, perhaps to preserve the body while it was transported back to the palace for burial. Who was the second person? Fortunately, the two skeletons lay with three gold bowls, each inscribed with the name of a different queen. One belonged to Yaba, wife of Tiglath-Pileser III (744–727 B.C.), a second bore the name of Atalya, the wife of king Sargon II (721–705 B.C.), and the third, and also a mirror cover, bore the name Banitu, the queen of king Shalmaneser, who reigned between Tiglath-Pileser III and Sargon II. The two deceased appear to be Yaba and Atalya, the latter having inherited some of the possessions of her predecessor. Some experts believe that Yaba and Atalya were mother and daughter, who married different Assyrian kings.

Unfortunately, questions about the security of the undisturbed tomb if it was left overnight meant that the sepulcher was excavated in a single afternoon. The excavators worked feverishly to recover the bodies and grave goods as carefully as possible. They established that both women had been buried fully clothed. Fragments of their garments survived, which, when analyzed, revealed an absence of animal products. This meant that the queens probably wore linen clothing, adorned with over 2,000 gold add-ons and other trinkets in various shapes. The gold objects from the tomb included a crown and diadem (see [Figure 19.1](#)), 79 earrings, six necklaces (combined with strings of semiprecious stones), 30 finger rings, 14 armlets, four anklets, and 15 vessels—over 15 kilograms of gold alone. A superb mirror with a finely carved handle inlaid with agate and gold lay on top of the bodies.

[Figure 19.1](#) A piece of Assyrian gold jewelry from Nimrud, Iraq.

Source: Courtesy of Bill Lyons/Alamy Stock Photo.

Four months later, another even more spectacular tomb came from an adjacent room. Again, a ridge in the floor provided the clue, but this time robbers had emptied the sepulcher in antiquity. The excavators entered through the hole dug by the thieves and descended into the burial chamber with its empty sarcophagus. An inscription on the lid revealed that it had belonged to Queen Mullisu, wife of King Ashurnasirpal (883–859 B.C.). This was the earliest tomb of the three, but the doors to the antechamber could not be opened from the inside.

So the investigators searched for the proper entrance and eventually found it. To their astonishment, the antechamber held three large bronze coffins, two lying side-by-side, the third stacked on top of them. There were 13 skeletons in the caskets, also a large quantity of treasure, most of it in one coffin.

The treasures were astounding. The top of a gold crown in two parts was a trellis vine on top with a circlet adorned with gold daisies and pomegranates that fitted around the forehead. Winged figures joined the two halves. Blue lapis-lazuli grape bunches hung from the lower edge. Over 530 earrings, some tasseled diadems, many necklaces, and numerous small trinkets that once decorated clothing accompanied a golden ewer and a bowl inscribed with the name of Shamshi-ilu, who served as commander-in-chief to three Assyrian kings between 782 and 745 B.C.

Seven adults and six children lay in the three coffins. One strongly built man of 60–65 may be Shamshi-ilu himself. All of the deceased were buried some time after the royal burial had been looted. Who owned the treasure found with the bodies is unknown, but the objects were buried long after the queen died, one of them dating to a century after her death.

A fourth tomb was discovered in 1990, but this had been thoroughly looted except for the terracotta sarcophagus and two bronze saucer lamps still in their niches where they had provided light for the interment.

These dramatic discoveries came just as Saddam Hussein invaded Kuwait and the Gulf War began. The finds were hastily cleaned and examined, then stored in a vault in the Central Bank in Baghdad, where they remained until after the Second Gulf War in 2003.

We can speak in terms of a world prehistory, of a universal human history, for the earlier millennia of our past. This is hardly controversial, unless your faith dictates that you do not accept the theory of evolution and natural selection and you believe that God created the world 6,000 years ago, a chronology for human origins enshrined in the Old Testament. But what about later times, when the record is much more localized? Archaeology, you can argue, is unwritten history, a unique record of the past that can be used to write the hitherto unrecorded history of parts of the world such as North

America, Latin America, and tropical Africa, where written records came with the first Western exploration and colonization. This became an issue during the 1960s, when many African nations gained their independence and it became necessary to revise school and university textbooks that had much to say about European exploration and settlement but nothing about earlier African history. In many places, written records began in the 1890s with the establishment of Belgian, British, or French colonial rule, so the only sources of information about earlier times were oral traditions, which are notoriously unreliable chronologically and frequently contradictory.

Since the 1960s, the study of pre-Colonial African history has advanced by leaps and bounds, thanks to a close alliance among all kinds of academic disciplines, among them archaeology, anthropology, ethnography, historical linguistics, and oral history, with, of course, the addition of documentary history where available. Today, we have the broad outlines of 2,000 or more years of sub-Saharan African history that reveal an intricate mosaic of powerful indigenous kingdoms. Jenne-jeno in Mali's Niger Basin was an early trading town in the first millennium A.D. that thrived off the Saharan gold trade (two-thirds of Europe's gold came from West African sources in 1492, when Christopher Columbus sailed to the Bahamas). Ife, Benin, and other West African kingdoms developed magnificent art traditions that entranced the international art world in the 1890s (see [Figure 7.1](#) on page 104). A series of small towns along the East African coast formed an outpost of the monsoon trade across the Indian Ocean that carried African gold and ivory to India and beyond (see [Figure 19.2](#)). The "stone towns" received cloth and other exotica in exchange. Much of the gold and ivory came from the far interior of South Central Africa, via a trading post at Sofala south of the mouth of the Zambezi River. The chiefs of powerful cattle kingdoms based on Mapungubwe on the Limpopo River, and later at Great Zimbabwe in the country of that name, controlled the sources of supply. All of this once little-known African history is now to be found in school and university textbooks, much of it reconstructed from archaeological research (Connah, 2001).

[Figure 19.2](#) Exterior view of Fort Kilwa Kisiwani in Tanzania, a major port on the East African coast.

Source: Courtesy of John Warburton-Lee Photography/Alamy Stock Photo.

Despite very limited funding, many African governments actively support archaeological research because it is an important way of reinforcing and establishing cultural and national identities in an increasingly international world. There are dangers, however, for the very nature of archaeological research means that a great deal of fieldwork is conducted in small areas, with the result that our knowledge is uneven. This, inevitably, has led to concerns that archaeology will foster “tribalism” by focusing on the history of one group at the expense of another.

Archaeology is a primary source of unwritten history in an increasingly literate world. The inexorable forces of globalism are tending to blur cultural identities, many of which have deep roots in the remote past. In many parts of the world, archaeology is writing new chapters of history and throwing fresh light on such key issues as the first settlement of Polynesia and Australia, the development of agriculture in India, and the first settlement of the Americas. The task of writing a truly global history of humankind has hardly begun, and many surprises await us, such as the recent discovery that Chilean chickens shared DNA signatures with Polynesian fowls at least a century before Columbus (Storey et al., 2011). Does this mean that Polynesians visited the Pacific coast of South America? This is but one of many mysteries of the past that await future generations of archaeologists.

As previously noted, archaeology assumes a linear chronology—a lengthy human past going back over millions of years. Some non-Western societies object violently to archaeology on the grounds that they know their histories and define their world in terms of oral traditions and other accounts of their origins. Thus, to say that the first Americans crossed the Bering Strait about 15,000 years ago is both irrelevant and offensive. While some Native Americans embrace archaeology and regard it as an important way of preserving their history and traditional beliefs, others do not. One must never forget that there are many alternative ways of looking at the human past. Archaeology just happens to be one of them, but it is an approach that is widely embraced throughout the world. One of archaeology’s most

important roles in contemporary society is its unique ability to reconstruct long spans of human history in the absence of written records, and document the long story of emerging human diversity. In an increasingly interconnected world where, above all, we need to understand one another and our similarities and diversity, archaeology has a great deal to offer.

Archaeological Tourism

Both of us have traveled widely in search of the past and have visited many of the world's most extraordinary archaeological sites. The past is all around us in many forms—spectacular cities, palaces, and temples; burial mounds; caves and rock shelters; and inconspicuous scatters of stone tools. Archaeological sites, large and small, can provide deeply evocative moments and truly memorable experiences. Brian Fagan remembers being locked by accident in the tomb of Egyptian Pharaoh Amenophis II in the Valley of Kings. As he waited for the tomb to be reopened for the next package tour, he descended to the burial chamber, where the king's stone sarcophagus still remained. Suddenly, the lights went out. The silence was profound, the sense of something supernatural absolutely overwhelming. Then the lights went on again and the moment was lost.

Today, cultural tourism, which includes archaeology, is one of the fastest growing segments of the travel business (Bruner, 1996). Sites such as the Parthenon; the Temple of the Sun God Amun at Karnak, Egypt; Stonehenge; and Teotihuacán, Mexico, receive millions of visitors a year, most of them on carefully organized and scheduled package tours. Today, more people visit the Pyramids of Giza in one month than would have visited them over many years a century ago. Today, thanks to the jumbo jet and the cruise ship, the past is under siege by visitors. It was not always so. Persepolis in Iran was the seat of the Achaemenid kings, among them Darius I (521–486 B.C.), an architectural masterpiece famous for its columned buildings high on a terrace and a stairway adorned with friezes of subject peoples bringing tribute (see [Figure 19.3](#)). In 1914, English Colonel P. M. Sykes scaled the stairway on his 16-hand horse and was overwhelmed by the view from the top. He had the place to himself. Today, you arrive in an air-

conditioned bus and spend a tightly scheduled two hours in a fenced and controlled archaeological environment. The quality of the experience is completely different.

What was once an adventure enjoyed by a few has become mass-market tourism. At the island of Mykonos in the Aegean Sea, Fagan recently watched a huge cruise ship offload more than 500 passengers into tenders, which ferried them to the island shrine at nearby Delos. When he was there in 1979, there were but a handful of visitors. Archaeology has turned from a leisurely pastime of the wealthy and well connected into an economic powerhouse for many countries, among them Egypt, Greece, and Mexico. Today, even hitherto relatively inaccessible sites such as the Khmer palaces and temples at Angkor Thom and Angkor Wat in Cambodia are on the international tourist circuit (see [Figure 19.4](#)). One forecast projects that 4.3 million tourists will visit Angkor Wat by 2020, a quantum jump over today's figure of some 250,000. The economic impact on the nearby town of Siam Reap has already been significant. Luxury hotels are mushrooming; shanty shacks line the road to the ruins; the infrastructure is under stress. Unfortunately, the huge investment required to make the area a true global tourist destination is beyond Cambodia's ability to afford. But the long-term impact of archaeology here, and at other sites—such as Rapa Nui (Easter Island) in the Pacific—is potentially enormous.

[Figure 19.3](#) The eastern stairway of the Apadana palace at Persepolis, Iran, ascended by Colonel Sykes on a horse in 1914.

Source: Courtesy of robertharding/Alamy Stock Photo.

A fascination with the ruins of the past, with archaeological sites spectacular and unspectacular, has been part of Western consciousness since Roman times. Today, this fascination has become big business, to the point that the sheer volume of visitor traffic is eroding major archaeological sites like Angkor Wat, the Roman city of Ephesus, and Maya Tikal. We archaeologists face an appalling dilemma. On the one hand, it's wonderful that millions of people are being exposed to the major sites of antiquity. On the other hand, the sites themselves are slowly being destroyed by visitor traffic, to the point that many of them are becoming less accessible to the public. You can no longer walk

among the stones at Stonehenge, except with a special permit. The 15,000-year-old paintings at Lascaux in France are inaccessible. Visitors descend into a superb, accurate replica, which is, for all intents and purposes, as good as the original—until you visit a less-frequented cave, such as Pech Merle, where the horses and other animals seem to have been painted yesterday (Bahn, 2016). (See [Figure 19.5](#).) As visitor counts increase, so people are being kept at a distance. You can no longer walk among the columns of the Temple of Poseidon at Sounion in Greece, a place famous for its spectacular sunsets when the columns glow with a deep rosy hue from the setting sun. What will the future hold? Will the world's most spectacular archaeological sites be off limits to everyone except professionals? Such a solution is unthinkable, but there seem to be few other affordable options.

[Figure 19.4](#) Ta Prohm, Cambodia, an exquisite Khmer temple, dedicated to King Jayavarman VII's mother in A.D. 1181.

Source: Courtesy of Hemis/Alamy Stock Photo.

[Figure 19.5](#) A Cro-Magnon painting of a wild horse adorned with dots and associated with a handprint from Pech Merle cave, France, approximately 15,000 years old.

Source: Courtesy of Granger Historical Picture Archive/Alamy Stock Photo.

Archaeology has led to major moneymaking in the international tourist scene, but few countries can afford to spend the money to protect major sites from overcrowding. Nor are prospective tourists going to be happy if they are diverted to less well-known, not-so-spectacular locations.

Quite apart from the daunting task of protecting major sites from an ever-growing onslaught of tourists, there is another factor—that of human imagination. The past tends to unleash the romantic in visitors, especially if a site is virtually empty and you have the place to yourself. Teotihuacán is so vast that you can easily wander off the beaten track and imagine life in a crowded barrio or admire the architecture of a building along the Avenue of the Dead (see [Figures 15.14](#) on p 301 and [15.15](#) on p 302). The Temple of the Egyptian Sun God Amun at Karnak has numerous side chambers, in at least one of which you can see a bas-

relief of the scribe god Thoth still with its original paint (see [Figure 8.2](#) on page 128). Such images add a special dimension to your experience, for visiting the past is far more than just looking at rows of building blocks and fallen columns. Any archaeological site has two values: one as a material artifact, the other as an inspiration to artists and to visitors with curiosity and imagination. As the art historian Christopher Woodward wrote: “You can uproot that alder tree ... erect more fences, spray more weed-killer, excavate and polish. You will preserve every brick for posterity, and analyze the occasional discovery of an ornamental fragment in a learned publication. You will have a great many bricks, but nothing more” (Woodward, 2003: 35). Visit Ephesus, Tikal, Chaco Canyon, or Stonehenge, and thoroughly trained guides will bombard you with facts and dates, with descriptions of architectural styles, with names of gods and goddesses. They rightly describe scientific findings, so their work is often devoid of emotion and imagination—the very stock-in-trade of the perceptive archaeological traveler who desires more from his or her visit.

Archaeology in contemporary society is far more than recitations of facts and finds, far more than well-organized, sanitized ruin fields that to the outsider represent little more than rows of marble blocks. Many writers have reminded us that the past is a foreign country, far removed from our world, a place inhabited by science and our imaginations. In one sense, we archaeologists have done our job, for we have brought an appreciation of the remote past, of our collective cultural experience, to the forefront of travelers’ minds. But we should never forget that it is our curiosity, our lively minds, and our evocative experience that bring it to life for us to enjoy. For example, the stadium at Olympia, Greece, the site of the first Olympic Games, is today a quiet, sterile place, where one can see two earthen banks, the starting blocks, and the passageway that led athletes to the start (see [Figure 19.6](#)). The guides dutifully recite the basic information about the site. But it takes a step further, a digging into one’s imagination, to make the stadium come alive—the jostling, shouting crowds, people drinking from wine skins, the smell of sweat and olive oil, pickpockets working the crowd, the lowing of sacrificial oxen in the background. Then there’s a sudden hush as the runners line up, the triumphant shouts of victory, the smell of wood smoke and garbage drifting on the evening breeze. To get the idea, read

the Spanish conquistador Bernal Diaz del Castillo's immortal description of his first sight of the Aztec capital in 1519: "These great towns and temples and buildings rising from the water, all made of stone, seemed like an enchanted vision... . Indeed some of our soldiers asked whether it was not all a dream ... I stood looking at it, and thought no land like it would ever be discovered in the whole world... . But today all that I then saw is overthrown and destroyed; nothing is left standing." Accepting archaeology as part of today's world means accepting that the past was not just artifacts; it was a place where people like us lived and died, fought and made love, argued, experienced happiness and bereavement. Archaeology is important today because it is the story of us, and because millions of people can now enjoy the achievements of our forebears in ways that were unimaginable even 50 years ago.

Figure 19.6 The ancient stadium at Olympia, Greece.

Source: Courtesy of David Ball/Alamy Stock Photo.

Archaeology and Subsistence Agriculture

Millions of people throughout the world still live at the subsistence level, using agricultural methods that were developed hundreds, if not thousands, of years ago. Farmers who live from harvest to harvest tend to be conservative in their outlook, for they are acutely aware that the price of crop failure is hunger. They survived, and still survive, because they have an intimate knowledge of their environment, of the crops that do well in different soils, and of their storage properties. In most places, however, population densities have risen sharply over the past century, partly because of somewhat improved medical care and better control of animal diseases. Rising population densities have meant more land clearance, to the point that in many areas people have "eaten up" the more fertile soils, fallow periods when gardens are left to regenerate fertility are reduced, and the cultivators have moved on to less fertile soils. The problem is enormous. In parts of sub-Saharan Africa, only about 40 percent of the soils are moderately fertile by agricultural standards, so the best farming land is heavily used. At the same time, many traditional practices used by earlier generations have been lost,

which is where archaeology has an important role to play. Thousands of acres of abandoned hillside terraces and numerous long-disused raised gardens in the Basin of Mexico testify to highly efficient land management practices in the past (Sanders et al., 1979). Almost invariably, modern development research lacks time depth, the perspective given by archaeology, which is the only scientific discipline capable of studying land management and culture change over long periods. Archaeologists have long disproved the common assumption on the part of development agencies that subsistence agricultural methods were “primitive” and inefficient. One only has to look at subsistence agriculture in medieval Europe a thousand years ago to get the point.

Our remote ancestors knew their environments intimately and developed highly effective, and sometimes long-forgotten, ways of growing crops and protecting themselves against the hazards of frost and famine. Archaeology provides a way of reconstructing ancient farming practices and thereby contributing to modern-day economic development. As early as 1000 B.C. , farmers living on the *altiplano* (high-altitude plains) along Lake Titicaca in southern Peru and Bolivia were using raised fields, elevated planting surfaces that were used to grow crops in areas that were subject to seasonal flooding. The soils were rich, and by elevating them and building a canal network, prehistoric cultivators were able to grow potatoes, quinoa, and other indigenous crops with impressive yields. The powerful Tiwanaku state dominated a large area of the Andean highlands and traded extensively with the Pacific coast during the first millennium A.D. Tiwanaku depended heavily on raised field agriculture, until a prolonged drought 1,000 years ago caused Lake Titicaca to shrink drastically and local water tables to fall. Raised field agriculture imploded over a wide area during the drought. Tiwanaku collapsed. Many more raised fields were abandoned before the Spanish Conquest of four centuries later. The modern economy of the same environment is mainly based on llama and alpaca herding.

Enter the archaeologists, led by Alan Kolata, who were carrying out long-term excavations at Tiwanaku as well as investigating the surrounding landscape and changing ancient settlement patterns. They identified traces of long-abandoned raised field systems below hillsides

where the local farmers planted potatoes in thin soils, only to lose much of the crop to frost and intense cold. Archaeologist Clark Erickson (1992) and a team of agronomists excavated some of the old field systems, then gave potato seed to a farmer. He dug up the soil of the arid pampa, piled up layers of gravel, clay, and soil just like those exposed in the excavator's trenches, and built shallow irrigation canals alongside his freshly created raised fields. The green shoots of the potatoes grew far higher than those on the slopes. As the temperature fell, a white cloud of warm air formed over the raised plots, masking them from view. Each day, the warming sun burned off the cloud, revealing green plants little affected by frost, whereas those on the slopes were withered by the cold. Between 1981 and 1983, the farmer harvested about 11 tons (10 tonnes) of potatoes per 2.5 acres (1 ha), compared with an average of 3.3–4.4 tons (3–4 tonnes) per hectare on the unirrigated slopes. Yields varied from year to year, but were always higher, for temperatures in the field systems were 1.8–3.4°F (1–2°C) higher and frost conditions lasted for much shorter periods.

The raised fields did not require elaborate technology to create, plant, and maintain, but required an initial high labor investment that was more than offset by multiple harvests and lower risks over a long period of time. Erickson's experiments were so successful that more than 2,125 acres (860 ha) were rehabilitated by as many as 34 communities. Whether these experiments will survive in the long term is unknown, but the collaboration between archaeologists and farmers showed the potential for rich dividends in the future.

Archaeologists' experiments with reconstructions of ancient raised gardens showed that excellent crop yields could be obtained from the ancient plots, in areas considered marginal by modern agricultural authorities, who think in terms of large-scale industrial agriculture. The traditional system has many advantages: high yields, no need for fertilizer, and much reduced risk of frost or flood damage. Archaeologists are actively involved in several other such projects in the Americas, notably in the Bolivian Amazon, where ancient farmers completely domesticated the landscape (Erickson, 2006).

Garbology

Archaeology has also worked directly for contemporary American society, especially in the management of resources and waste. University of Arizona archaeologist William Rathje has studied the garbage dumps in Tucson and other cities for a long time (Rathje and Murphy, 1992). His team examined patterns in garbage thrown out by city households, used the latest archaeological research designs and techniques to analyze evidence from the dumps, and joined to it data gleaned from interviews with householders and other sources. His study revealed startlingly wasteful habits in Arizona households of many economic and social backgrounds, information that could be used to suggest better strategies for consumer buying and resource management. Because the objects we use shape our lives in many ways, we need to understand how they affect us to learn about the past and anticipate the future. In recent times, “garbology” has spread to other North American cities, and has played a significant role in formulating some recycling policies. The research is sometimes sponsored by manufacturers, like those of cat food, to provide information for marketing purposes.

Archaeology and the Environment

The past is always around us, encouraging, threatening, offering precedent for the future. Tens of thousands of years of human experience provide us with diverse perspectives on the present and the future. One cannot, of course, use the past to forecast the future, but it certainly helps shape our thinking about what lies ahead.

A thousand years ago, extensive droughts descended on western North America, the Maya lowlands in Mesoamerica, the Andes, and wide areas of northeastern and eastern Africa (Fagan, 2008). These prolonged arid cycles occurred during the so-called Medieval Warm Period, four centuries of often slightly warmer climate over much of the world. The warming brought many years of good harvests to medieval Europe and saw the emergence of the High Middle Ages. Favorable ice conditions in the North Atlantic allowed the Norse to sail west to Greenland and then to North America. However, the same centuries brought suffering and great cultural adjustment to many areas of the tropical and subtropical world. The amount of warming was only a few

degrees, small by the standards of the potential warming of the twenty-first and twenty-second centuries, but the droughts that resulted were far from trivial in their effects. Until very recently, the droughts of the Medieval Warm Period were virtually unknown, but a combination of archaeology and climatology has revealed a hitherto neglected chapter of history.

Archaeology tells us about 1,000 years ago, but what does the future hold? Britain's authoritative Hadley Center for Climatic Prediction and Research documented a 25 percent increase in global drought during the 1990s, which produced well-documented population losses. The Hadley's computer models of future aridity resulting from the impacts of greenhouse gas emissions are truly frightening. At present, extreme drought affects 3 percent of the earth's surface. The figure could rise as high as 30 percent if warming continues, with 40 percent suffering from severe droughts, up from the current figure of 8 percent. Fifty percent of the world's land would experience moderate drought, up from the present 25 percent. Then the Center ran the model without factoring in the impact of greenhouse gasses, for they assumed that such gases were the temperature change villains. They indeed found that future changes in drought without anthropogenic warming would be very small indeed.

In human terms, the United Nations Environment Programme reports that 450 million people in 29 countries currently suffer from water shortages. By 2025, an estimated 2.8 billion of us will live in areas with increasingly scarce water resources. Twenty percent of the world's population currently lacks access to safe, clean drinking water. Contaminated water supplies are a worse killer than AIDS in tropical Africa. If the projected drought conditions transpire, future casualties will rise dramatically. The greatest impact of intensifying drought would be on people already living in arid and semi-arid lands—about a billion of us in more than 110 countries around the world. And those who would be hit hardest are subsistence farmers, especially in tropical Africa. Seventy percent of all employment in Africa is in small-scale farming and completely dependent on rainfall. The number of food emergencies in Africa each year has already almost tripled since the 1980s, with one in three people across sub-Saharan Africa being malnourished. Future drought-related catastrophes will make these

preliminaries seem trivial and could affect more than half of tropical Africa's population.

Archaeology's startling climatic findings from 1,000 years ago have a direct relevance to the environmental problems we face today and will have to combat in the future. As we saw in [Chapter 12](#), archaeology tells us how a wide variety of human societies have adjusted to major climatic fluctuations during the Ice Age, to universal warming after 15,000 years ago, and to such short-term events as El Niños. Environmental archaeology is a chronicle of human adaptation to rapid and slow changes, of responses to floods, droughts, shifts in monsoon patterns, sea level rises, and changes in distributions of wild life—to mention only a few examples. It's also a story of increased human vulnerability to sudden climatic changes and natural disasters of all kinds. This vulnerability increased with the development of farming, and especially of sedentary cities and civilizations. Ancient Egyptian civilization almost collapsed as a result of poor Nile floods in about 2100 B.C. Much of Santorini Island in the Aegean Sea blew into space during a catastrophic volcanic eruption that buried the village of Akrotiri under lava and sent ash clouds and tsunami waves over wide area of the eastern Mediterranean world. Vesuvius destroyed the Roman towns at Herculaneum and Pompeii in A.D. 79. A combination of climatic shifts, volcanic activity, and plagues contributed to the implosion of the Roman Empire (Harper, 2017). Moche civilization on Peru's North Coast reeled under the impact of earthquakes and El Niños during the first millennium A.D. The list goes on and on, with an estimated 20–30 million people dying of famine and famine-related diseases in the tropical world as a result of monsoon failure during the nineteenth century alone (Davis, 2001).

To what extent were these and other ancient societies aware of their vulnerability, or of the way in which population size and agricultural intensification were increasing that vulnerability? Famine was certainly not unknown, even in the relatively stable environment of the Nile Valley. Likewise, some societies were aware of irrigation-related problems such as long-term salinization, but appear to have devised measures to cope. Here the traditional knowledge of farmers themselves—the experience built up over centuries—must have been a major factor in achieving a high level of sustainability lasting several millennia. We

may suspect, nonetheless, that early state societies had the same problem as modern societies in implementing effective policies to deal with long-term risks; like global warming today, phenomena that appear unthreatening in the present but have consequences for the future are simply too remote in time for the normal span of a human lifetime. However clear the threat, effective action is very difficult to mobilize. Yet in very fragile circumstances, early societies did go to extraordinary lengths to strive for some security, as exemplified by the construction of intervalley canals along Peru's North Coast a thousand years ago. This may be interpreted not as a response to immediate need but as a measure to anticipate and to counter future droughts such as that which so severely damaged the Moche state.

What is evident above all is the fragility of the relationship between ancient civilizations and their environments. This relationship, and the human response to crisis when it has occurred, must, however, always be viewed in the context of social, political, and cultural factors. For instance, the needs of the elites in early states like that of the Maya for wealth and tribute—to support their high-status lifestyles or to fuel territorial expansion—compounded the problems of population growth and led in many cases to an intensification of agriculture that was close to the limit of sustainability given the technology available. In some cases, these pressures drove processes of change and collapse over which human agents—whether rulers or ruled—had little effective control. In a few instances, changes arising from natural causes were so overwhelming that it would be hard for any society to cope adequately. But in all cases, the outcome owed much to human factors—the high density and distribution of population, the agricultural technology, and particular social strategies.

Several societies appear to have been responsible for environmental degradation, and, in that sense, may be said to have contributed to their own demise. But again, we must note the long-term sustainability demonstrated by Ancient Egypt or Mesopotamia, albeit with fluctuating fortunes. Thus, there is no simple answer. What is true of early state societies is also, of course, the case in the modern world, where human attitudes as much as scientific evidence drive the contemporary debates over chlorofluorocarbons (CFCs), greenhouse gases, and genetically engineered crops.

We do know from archaeological records, however, that human responses to disaster and drought have changed little over the past 5,000 years. They show that ties of family and kin are some of the most effective mechanisms for handling, and recovering from, disaster.

Archaeology offers us rich archives of environmental information and has a key role to play in studies of self-sustainability.

Heritage and Stewardship

[Chapter 1](#) described the goals of archaeology, the first of them being conserving and managing the world's archaeological sites. [Chapter 1](#) also discussed the ongoing crisis of the past—the inexorable destruction of the finite archaeological record throughout the world due to deep plowing and mining, inexorable urban expansion, and the activities of looters. Until recently, all archaeologists were concerned primarily with discovery, the chronicling of world prehistory and the human past from the earliest times up to the Industrial Revolution and beyond. Some excavators in Britain recently carried out a controlled dig on a Ford van buried in the 1960s. Today, the focus is shifting dramatically, from original discovery (although, of course, that is still important) to a fundamental concern for conservation and management (see [Chapter 18](#)) and for issues of cultural heritage.

Archaeology is a truly international enterprise, concerned with a vanishing archaeological record throughout the world. This record comes in many forms—as early hominin caches at Olduvai Gorge in Tanzania, as deep rock shelter deposits in southwestern France, as scatters of stone artifacts chronicling the first Americans. We investigate early farming villages, southwestern pueblos, and entire cities. Our universal cultural heritage is enormous, dating from all time periods, and something that should be of concern to us all.

Powerful forces of nationalism lie behind much archaeology, despite the universal importance of cultural heritage as something belonging to us all (Kohl and Fawcett, 1995). Major Western museums contain rich collections of Assyrian, Egyptian, and Maya antiquities, to mention only a few. These holdings arrived during the rough-and-tumble days of nineteenth-century archaeology, when many expeditions to countries, such as Egypt, Greece, and elsewhere were little more than

treasure hunts (Fagan, 2004). As late as the 1920s, the British Museum Egyptologist Wallis Budge called the Egyptians the “principal robbers” of their heritage. Then, in a splendidly pompous piece of logic, he wrote:

Every unprejudiced person who knows something of the subject must admit that once a mummy has passed into the care of the Trustees, and is lodged in the British Museum, it has a far better chance of being preserved there than it could possibly have in any tomb, royal or otherwise, in Egypt. The Ancient Egyptian craved immortality, which further residence along the Nile could not guarantee. In the British Museum he is placed beyond the reach of all such evils.

(Budge, 1920: 145)

One cannot entirely blame Budge for his remarks at the time, for the infrastructure of museums now in existence around the world barely existed in his day. Nor were archaeological sites the powerful economic draw that they are today. Nevertheless, there were calls for the return of the Parthenon’s Elgin Marbles from the British Museum throughout the nineteenth century, calls that persist to this day (see the Site box). Greece, Egypt, Italy, and Peru have been particularly vociferous about looted antiquities in recent years, to the point that some prominent institutions such as the Getty Museum and the Metropolitan Museum in New York have returned some specimens to their countries of origin and received other original artifacts on long-term loan. Today, almost no Western museums acquire artifacts without their having documented provenance. The export of archaeological finds from most countries is now, at least in theory, strictly controlled, although, regrettably, the international antiquities trade continues to flourish and grow inexorably, despite efforts to curb it.

The furor over the export of archaeological finds reflects the economic value of cultural heritage and of efforts by governments around the world to foster national identity, this apart from usually unsuccessful attempts by some to use archaeology to foster nationalist agendas. The controversies are also a reflection of a growing recognition that archaeological sites of all kinds are part of the universal cultural heritage of all humanity, and, as such, are worth

preserving. Now one of the primary responsibilities of archaeologists everywhere is stewardship.

Stewardship in archaeology is the process of managing and preserving the archaeological record for present and future generations. This is a responsibility that is part of the basic ethical practices of all archaeologists and is also the responsibility of governments. In the United States,

The National Park Service is steward of many important archaeological resources, among them the pueblos of Chaco Canyon, New Mexico. Stewardship is very much a long-term perspective on cultural heritage, for one is concerned here not with preserving the record for a generation but indefinitely. This is something that most archaeologists have only just begun to think about, especially in the context of cultural resource management. Stewardship is also a major concern in areas and at sites where cultural tourism is expanding rapidly. Places such as Rapa Nui in the South Pacific and groups such as the Haida Indians of British Columbia's Haida Gwaii and the Hopi of the Southwest have major issues of stewardship, involving everything from basic research and site conservation to controlling visitor traffic and preserving the integrity of the surrounding natural environment.

S i T E > The Elgin Marbles, the Parthenon, Greece <

In the fifth century B.C. , in the Parthenon on the Acropolis in the heart of Athens was the shrine of the goddess Athena, who was born from the forehead of Zeus and was patron goddess of the city. As classical Athens faded, so did the mighty temple. For hundreds of years, the Athenians, now reduced to living in a village, robbed the Acropolis for building stone. In later centuries, occupying Turks used it as a powder magazine when fighting the Venetians. The temple was bombarded, but the columns still stood. Then, in an act of unspeakable vandalism, the English diplomat Lord Elgin bribed and cajoled the Turkish authorities, then removed the friezes from the temple between 1801 and 1804. He sold what became known as the Elgin Marbles (see [Figure 19.7](#)) to the British Museum in London for the then colossal sum of £30,000, where they remain, despite repeated efforts by the Greek government to get them back, efforts that began as early as 1829.

The Greek government has tried to get the marbles back from the

British Museum for a century. They are spending large sums on conserving the Parthenon—iron braces deployed three quarters of a century ago to stabilize masonry blocks are giving way to titanium reinforcements; columns are being carefully strengthened and repaired, metopes (decorated spaces on temple friezes) hoisted in place from the jumble of carefully numbered temple fragments on the ground. Greek conservators are replacing the surviving sculptures with precise replicas, far more durable than the priceless originals. But the Greeks still want the originals returned, so they can display them under controlled conditions in a special museum at the foot of the Acropolis.

A century ago, the British could argue with some justification that the marbles were safer in London than in Athens—not that the conservation measures of the museum were anything to write home about. But now times have changed. Greece has invested enormous resources in its classical monuments, determined that they survive for present and future generations to enjoy. Their concern is partly for their cultural patrimony but is also fueled by the burgeoning interest in cultural tourism. No one who visits the superb museum at ancient Olympia, or will visit the state-of-the-art museum being constructed at the foot of the Acropolis, can doubt that the Greeks would take good care of the Parthenon marbles. If returned to Athens, they would be housed in a climate-controlled museum, with precise replicas on the original temple. Visitors would be able to enjoy the originals and also gain insight into the original appearance of the Parthenon. Why not return the marbles to Greece, having made a set of replicas for the British Museum? The goodwill would be enormous, and the audience for the marbles would be vastly expanded. Above all, they would return to the land of Phidias, the sculptor who crafted them, and enhance the Parthenon as a symbol of intense national pride. To many, the moral of this prolonged affair is that cultural heritage of this importance is everyone's property, but the place where Phidias's masterpieces belong is at home.

Figure 19.7 The genius of the sculptor Phidias: a horse's head from the Elgin Marbles from the Parthenon, Greece.

Source: Courtesy of Steve Taylor ARPS/Alamy Stock Photo. © *The Trustees of the British Museum/Art Resource, NY.*

However, the story is not so simple and, as we have seen, the British Museum resists their return. Would their return set a new precedent? Should not all foreign artifacts then be returned to their true homes? Where would it stop? If they come from an economically or politically unstable country, how can we ensure that all the artifacts are then adequately protected? Moreover, given that the British is the United Kingdom's most-visited cultural site (and is entirely free to get into), it is clearly doing its job of attracting, informing, and educating vast numbers of visitors—albeit those who can afford to visit Britain in the first place. It is also worth noting that the British Museum now has an excellent record of working with overseas archaeologists and collections. Steeped in a colonialist past, but trying to forge ahead in the modern world, the question of repatriating the marbles is a moral maze if ever we saw one.

Stewardship is far more than archaeologists taking steps to stabilize an adobe wall or building paths to steer tourists through a ruined city. The entire process requires extended consultation with **stakeholders**, people with a vested interest in the resource. Who, after all, owns the past? Stakeholders come in many forms. At Olduvai Gorge, Masai cattle herders graze their herds close to where the Mary Leakey found *Zinjanthropus*—and they have a right to do so. At Chaco Canyon, complex issues of ancestry and landownership, involving Native American responsibility for the national monument, extend back generations. Annapolis, Maryland, has many stakeholders in its historic sites, among them city government, descendants of historic residents, current homeowners, and historic preservation experts, to say nothing of archaeologists and tourists, even the nearby Naval Academy. Stewardship requires prolonged and often frustrating consultation with stakeholders with legitimate interests in the resource, which may not necessarily be compatible with those of archaeologists. We are all owners and stewards of the past, which is why much archaeology involves local communities and other stakeholders. The human past is owned by no one. It represents the cultural heritage of everyone who has ever lived on earth or will live on it in the future. Archaeology puts all human societies on an equal footing.

Governments and archaeologists alone cannot possibly assume all responsibility for stewardship of the past. It is a responsibility that lies

with all of us, whether archaeologist, landowner, or private individual, however significant or insignificant our interest in human history. Fortunately, a number of quasi-governmental and private organizations are involved in issues of cultural heritage. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) was founded in 1972 to foster the conservation and protection of exceptional cultural and natural heritage sites around the world. UNESCO's list of such locations has been a powerful catalyst for raising awareness of the importance of cultural heritage throughout the world. The listed resources range over the entire spectrum from archaeological and art sites to areas of exceptional botanical or geological importance or of exceptional natural beauty. Over 750 archaeological sites are on the list, among them Chaco Canyon, Machu Picchu, and Stonehenge. UNESCO provides assistance for endangered sites, offers training programs, and helps disseminate information about the sites it monitors. UNESCO's most famous projects were the moving of Rameses II's Abu Simbel temple to higher ground as part of the building of the Aswan Dam across the Nile (see [Figure 19.8](#)) and the building of an artificial island as a permanent haven for the Temple of Isis at Philae, also near the First Cataract, which had been flooded by another dam in the early twentieth century. The Philae project, carried out with the Egyptian Antiquities Authority, involved moving the entire temple, which was inundated for part of each year.

The U.S.-based Archaeological Conservancy, mentioned in the previous chapter, is a nonprofit organization dedicated to acquiring endangered archaeological sites and preserving them in perpetuity. Over the past quarter century, the Archaeological Conservancy has acquired nearly 300 sites through donation and purchase, including large pueblos in New Mexico, mounds in eastern North America, an early Spanish mission in Arizona, and Paleo-Indian sites. Some of them are passed on to become part of established parks, such as Chaco Canyon. With over 23,000 members, the Archaeological Conservancy is a vibrant organization with its own magazine, *American Archaeology*, and a flourishing cultural travel program. For more information, or indeed to join up, please visit their website, www.americanarchaeology.com. Alternatively, you can write to the Archaeological Conservancy at 5301 Central Ave NE, Suite 902,

Albuquerque, NM 87108.

Figure 19.8 Rameses II's temple at Abu Simbel, Egypt, moved to higher ground to save it from inundation by the waters of Lake Nasser.

Source: Courtesy of Shutterstock.

Archaeology has become an integral part of life in the contemporary world, an essential element in the fabric of popular culture. But its greatest achievement lies in the new chapters of history that have come from the trowel and the spade over the past two centuries. The work of exploring the past has hardly begun, and herein lies archaeology's greatest significance in today's world—helping us acquire a better understanding of ourselves, of *H. sapiens*.

Summary

1. Archaeology is now an integral part of popular culture, having previously been an esoteric discipline that was mainly academic.
2. Archaeology, being the only science that studies human societies over long periods of time, not only writes the unwritten histories of societies in all parts of the world but also makes a unique contribution to our understanding of human biological and cultural diversity.
3. Archaeological and cultural tourism are two of the fastest-expanding segments of international tourism, to the point that archaeology is a major moneymaker for several national economies. Archaeological tourism raises serious conservation issues and also issues of access, as the most popular sites are inundated with visitors.
4. Archaeologists have made major contributions to the study of subsistence agriculture around the world. In some cases, notably in South America, reconstructed field systems from archaeological investigations have resulted in the reintroduction of traditional, and virtually forgotten, farming methods.
5. Modern garbage disposal has become a fruitful avenue of investigation for archaeologists, who have investigated urban refuse using archaeological methods.

6. Studies of ancient climate change have a direct relevance to today's concerns about global warming caused by humans, especially in the context of drought.
7. Archaeology is a major player in the presentation and conversation of heritage and is a major stakeholder in such issues, as well as being a vital element in efforts to conserve the past for future generations.

Further Reading

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PART VII

CAREERS AND RESOURCES

Chapter 20 is about archaeology—as a career and a hobby, as an avocation and a part of all of our lives. In short, it’s about archaeology and you.



20

So You Want to Become an
Archaeologist?

CHAPTER OUTLINE

Archaeology as a Profession

Academic Qualifications: Graduate School

Thoughts on Not Becoming a Professional Archaeologist

Our Responsibilities to the Past

Excavating a Maya temple at dawn, Belize.

Source: Courtesy of Science Source.

Brian Fagan became an archaeologist by sheer accident, having entered Cambridge University in England without any idea of potential careers. He was admitted on condition that he studied anything except Greek and Latin, for which he had no aptitude whatsoever! So, he took a list of potential subjects and chose archaeology and anthropology on a whim, with no intention of making either a career. His first lecturer was a Stone Age archaeologist named Miles Burkitt, who was famous for his classroom stories. He had studied late Ice Age rock art under the legendary French archaeologist Henri Breuil before 1910. His enthusiastic reminiscences triggered Brian's interest in the past. By chance, while still an undergraduate, he met another famous archaeologist, the late African prehistorian Desmond Clark, and ended up working in a museum in Central Africa after he graduated. He has been an archaeologist ever since, a career choice he has never regretted.

Meanwhile, his co-author Nadia was one of those people who "always" wanted to be an archaeologist. She, too, studied archaeology at Cambridge University, and then went on to do a PhD in the archaeology of Arabia. After university, she started off working as a researcher on archaeological documentaries. However she soon moved full-time into archaeological editing and writing, including as the editor of both of Britain's leading archaeology magazines.

There are many different paths one can take, but how viable is archaeology as a career? This chapter is a brief essay on becoming (or not becoming) an archaeologist (for general career discussion, see Ellick and Watkins (2011) and Flatman (2011)).

Archaeology as a Profession

Archaeology still has an aura of romance and spectacular discovery about it, which probably accounts for why many of you took the course that assigned this book in the first place. You will soon learn that modern-day archaeology, while often fascinating and sometimes conducted in remote lands, is a highly technical discipline in which spectacular discoveries are few and far between. True, exciting finds occasionally hit the headlines, such as the Moche Lords of Sipán or the Uluburun shipwreck, but the fact remains that most archaeologists labor far from the public eye, often on unspectacular and sometimes downright monotonous sites or obscure problems. An Indiana Jones type of personality is certainly not a qualification for archaeology; indeed, it has never been. Indiana Jones himself is complete fiction, a character built up from a group of well-known pioneer archaeologists of the early twentieth century whose discoveries and adventures were indeed larger than life. Today's archaeologist is about as far from Professor Jones as you can get and probably works a long way from the halls of academe.

Personal Qualities Personal Qualities Needed by an Archaeologist

Anyone wanting to become an archaeologist needs far more than academic credentials. Here are some essentials:

- *Enthusiasm*; indeed a passion for archaeology and for the past, is the touchstone for anyone who enters this field. Archaeology thrives on enthusiasm, for the best archaeologists are those with the kind of fire in their bellies that enables them to raise money, overcome major practical obstacles, and carry out their work. Personal charisma breeds good archaeological leaders, provided they have the patience for the small details as well.
- *Infinite patience* is needed to carry out fieldwork and other research that can involve slow-moving, repetitive tasks and dealing with sometimes-difficult people.
- *A mind that thrives on detail* is very helpful, since a great deal of archaeology is minutiae—noticing the small attributes of stone

tools and potsherds, analyzing computerized data, and studying tiny details of the past for weeks on end. Both excavation and survey, to say nothing of laboratory work, require great patience and a concern for detail.

- *Adaptability*, an ability to put up with long journeys, sometimes uncomfortable fieldwork, and often primitive living conditions, is essential. You need to be fit enough to walk long distances and to thrive on improvisation under difficult conditions. Imagine, for example, filing Land Rover wheel bearings out of nails when you are several hundred miles from a service station so you can get home. I know archaeologists who have done that. They had to.
- *Good organizational skills* are required, since a great deal of archaeology is logistics and organization of field crews, site archives, and even camp kitchens. A good mind for organization is a great asset.
- *Cultural sensitivity and good people skills* are essential. Many of archaeology's most successful practitioners invest enormous amounts of time in cultivating people and communicating with Native Americans and other cultural groups. Such skills require great patience and sensitivity, but the personal satisfaction and rewards are immense. This is one reason why a background in anthropology is so important to an archaeologist.
- *A commitment to ethical archaeology* is also necessary. Do not become an archaeologist unless you are prepared to adhere to the ethical standards demanded of such professionals, some of which are spelled out in [Chapter 2](#).
- *A sense of humor* may seem self-evident, but it is vital, for many archaeologists take themselves far too seriously. Have you ever spent a week writing a paper, then had your computer implode before you have backed up your text, or had a trench wall collapse before you can record it? Moments like that beset all field research. That's why archaeologists need a sense of humor, because sometimes everything that can go wrong goes wrong—all at once.

All in all, the most important considerations are commitment and

enthusiasm. They will carry you through almost anything.

What, then, are the qualities that make a good archaeologist in these days of highly specialized research and wide diversity of career options? Qualities of character are as important as academic qualifications, which we discuss subsequently, for you will never become rich as an archaeologist. This is a profession that has its own unique rewards. Money is not one of them. (See the Doing Archaeology box.)

Deciding to Become an Archaeologist

Many people become archaeologists almost by chance. The occasional fieldwork experiences they had as an undergraduate were interesting and left them wanting more. This is not like becoming a priest or a nun, or signing up with the military, where a high degree of initial commitment is needed. You can ease your way into the field, and have a great time doing so, up to the point when you apply to graduate school.

Almost everyone we meet who is contemplating a career in archaeology either encountered the subject in high school or became interested as a result of taking an introductory course at a college or university. Many people are lucky enough to have a truly inspiring teacher, one who fires them with enthusiasm for a possible career they have never encountered before. What, then, should you do once your appetite for the past has been whetted?

First, take more courses in archaeology at the upper-division level from as broad a cross section of instructors as possible. Begin with an advanced method and theory course. (If that does not turn you off, then you know you are onto something, for such courses are not remarkable for their excitement!) Then take a selection of area courses, so you can find out which general areas of specialty interest you and which do not. Remember, if you apply to graduate school, you will need some specific interest as the potential focus of your degree.

Second, give yourself as thorough and as broad an education in general biological and cultural anthropology as possible, both to focus your interests and to see if living people interest you more than dead ones. If you do go on to become a professional, you will never regret

this exposure.

Third, take as many courses as you can in related disciplines, so that you emerge with strongly developed multidisciplinary interests. The most important and fascinating problems in archaeology—for example, the origins of agriculture—can be approached only from a multidisciplinary perspective. Much cultural resource management (CRM) archaeology is strongly multidisciplinary.

Last, gain significant field and laboratory experience while still an undergraduate. Such experience looks good on graduate applications, especially if it is broadly based. Even more important, it allows you to experience the challenges, discomforts, and realities of field and laboratory work before they become your job (and you should think of graduate school as a job).

If you take the trouble to acquire a broad-based experience of archaeology in your undergraduate years, you will be well equipped for graduate education and its pathways to a professional career.

Gaining Fieldwork Experience

“How do I go on a dig?” We’re asked this question dozens of times a year, especially by beginning students. The good news is that there are more opportunities to go into the field as an undergraduate than ever before, provided you are prepared to make the effort to find them. Begin by taking your department’s field course, if it offers one, then look further, using personal contacts and departmental bulletin boards as a start (see the Doing Archaeology box on page 403).

Career Opportunities in Archaeology

No one knows exactly how many professional archaeologists there are in the world, but the number is in the tens of thousands. Nine European countries, which participated in a recent survey, listed more than 16,500 of them, and there are many more elsewhere. The statistics for the United States are slightly more precise (figures and summary from Altschul and Patterson, 2010). There are some 9,350 of us, also about 2,200 archaeological technicians. Of the 9,350 professional archaeologists, 13.2 percent are in academia, 22 percent in government, and 45.4 percent (5,150) in the private sector, almost all in CRM.

Looking at long-term trends, it appears that the situation will change little in coming decades. CRM activity is funded through what is called “the polluter pays” principle, whereby those who disturb an archaeological site pay for the responsibility of mitigating their adverse actions. As long as this principle remains intact, and it probably will, CRM funding and activity will ebb and flow with the pace of development. CRM employment will continue to grow, but job growth will flatten in future years as it falls more in line with the fluctuating economy. One area does promise significant growth—heritage tourism, where many jobs may come into being with the goal of improving visitor experiences. But whether these jobs will involve research is an open question.

Discovering Archaeology Crow Canyon Archaeological Center

I think one of the best ways to find out if you are truly interested in archaeology, either as a profession or as a hobby, is through the nonprofit Crow Canyon Archaeological Center in Cortez, Colorado (www.crowcanyon.org) (Figure 20.1). The center’s mission statement spells out their objectives: “To empower present and future generations by making the human past accessible and relevant through archaeological research, experiential education, and American Indian knowledge.”

Every year, Crow Canyon runs a College Field School aimed at undergraduates and graduates. It’s an accredited program, so you can get 6 credit hours through Adams State University in Colorado (there is a fee per credit hour). It’s also certified by the Register of Professional Archaeologists. The school lasts five weeks and is designed to get your hands dirty in the field and laboratory. You learn the fundamentals of archaeological site identification and recording, also excavation, as well as the basics of artifact processing and analysis methods. These are all essential skills, expanded upon by evening programs, field trips, what are called “service learning projects,” and attending public events. You are in a field school that immerses you in the real world of archaeology and you carry out serious research on an Ancestral Pueblo site near the center. This is very much small group learning, for you work in groups

throughout the school, rotating between the different training modules, whose skills complement one another. Perhaps best of all, you interact constantly with working archaeologists, experienced field and laboratory experts, so you really learn what they think about and the problems they encounter.

Figure 20.1 Crow Canyon Archaeological Center: sifting at the Haynie Pueblo site, Colorado.

Source: Courtesy of Crow Canyon Archaeological Center, Cortez, Colorado, USA.

There are numerous other Crow Canyon programs that allow you to explore archaeology. They run a one-day overview of Southwest archaeology that is truly unique and led by professional archaeologists and educators. Other alternatives: you can be a “citizen scientist” and work alongside their archaeologists on a dig or in the laboratory. In the final analysis, Crow Canyon is a network of scholars who are everything from archaeologists to economists and educators, as well as Native American cultural experts, who teach about Native cultures. Their real interest is working with large and complex data sets, as are now finally becoming available to look at very basic, big questions. Above all, the center works closely with Native Americans as it studies not only the past, but the future.

There are some challenging career opportunities for suitably qualified people, but the skills they will require are likely to be considerably different from those of the conventional academic archaeologist. Let’s look at little more closely at different career paths.

Academic Archaeology This field is shrinking. A generation ago, almost all archaeologists were faculty members at academic institutions or worked in museums or research institutions. Purely academic archaeology still dominates both undergraduate and graduate training, and there are many people who enter graduate school with the resolute ambition of becoming a “traditional” research scholar. But growth in academic positions is now very slow. Some programs are shrinking, as more and more institutions shift over from tenure-track faculty to contract teachers for archaeological courses (Zeder, 1997).

Most archaeology in North America and many parts of Europe is now conducted as CRM projects, much of it mandated by law. This means that more and more (but certainly not all) academic archaeology in American universities is conducted outside the United States, most commonly in Europe, Mesoamerica, and the Andes. There is intense competition for the rare vacant academic jobs in such well-trodden areas as Mesoamerica and even more applicants for the scarce academic positions in North American archaeology.

The number of academic archaeologists is shrinking every year, but there will always be limited demand, mainly to replace people who are retiring. If you want to go into academia, beware of overspecializing or of working in too-crowded fields, and have other qualifications such as CRM or computer skills at your disposal.

Doing Archaeology Fieldwork Opportunities

Fieldwork opportunities abound, if you take the time to look for them. Here are some possibilities:

Volunteer on an excavation or survey sponsored by your own institution. Ask your instructors about possible opportunities. Once they see that you are serious, they may be delighted to use you in the field or laboratory.

Volunteer on fieldwork sponsored by a local or national organization, such as a historical society, museum, or government agency. Many of our students have served as interns for the National Park Service and other organizations. The internet is a useful source of information about such opportunities, as is your department bulletin board, which advertises fieldwork opportunities (see the Useful Addresses section at the end of the chapter).

Attend field school. Many institutions sponsor summer field schools for credit. The most popular and rigorous field schools are in heavy demand and are filled by competitive application, sometimes by graduate students. General field schools are worthwhile because they combine excavation, laboratory analysis, and academic instruction into one intensive experience. And the camaraderie among participants in

such digs can be memorable. Very often, attendance at a field school gives you a basic qualification that will help in getting summer work with a research institute or a private contract firm. The Society for American Archaeology (see the Useful Addresses section at the end of the chapter) and the internet will provide information, as will mailings sent to your department. Choose your field school with care! All are not equal, and you should take advice from your instructors before committing yourself. A word to the wise: Beware of summer field schools that offer you a chance to excavate on archaeological sites in remote lands. Some of them, especially in the eastern Mediterranean, charge high fees and use students as unskilled labor, so you learn little. Check carefully before signing up, and insist on getting names of former students whom you can contact beforehand.

Participate in professional excavations. The Archaeological Institute of America and the Council for British Archaeology (see the Useful Addresses section at the end of the chapter) maintain lists of professional excavations that rely on serious volunteers. Sometimes they provide cheap or even free accommodation if you stay for a while.

Volunteer for CRM excavation. Many of our students get their first fieldwork experience by working as laborers on local CRM projects. Many of them begin as volunteers and are later paid for their work. It is worth checking with any private-sector CRM firms in your area, or consult your instructor, who may have contacts.

Volunteer for fieldwork opportunities with state and local archaeological societies. Such organizations, which abound, often run excavations and field surveys, which are an excellent way of gaining experience.

Museum Jobs These are hard to come by, especially purely research positions. However, a career in museum work is rewarding, and requires specialized training in conservation, exhibits, curation, or some other aspect of collections care in addition to academic training. An internship is an excellent way to learn about the museum world. There are graduate programs that train potential museum workers, but academic degrees in archaeology will be needed for senior research

positions.

Cultural Resource Management and Public Archaeology These areas offer almost open-ended opportunities to persons seeking a career in managing and saving the archaeological record (Altschul and Patterson, 2010). The greatest opportunities in archaeology during this century lie in the public archaeology arena and in the private sector, where the challenges are far more demanding than the traditional academic concerns. We would strongly recommend planning a career in CRM if you want to become a professional archaeologist, but be aware that many of the skills needed for such work are not taught in conventional academic graduate programs. There are a few universities that offer MA programs in CRM archaeology, and there are PhD opportunities, but their numbers and offerings change literally yearly according to demand, so we cannot give specific information here.

If you are interested in public archaeology or CRM, you have the choice of working either in government or for some form of organization engaged in CRM activity, which can be either a not-for-profit group, perhaps attached to a museum, college, or university, or a for-profit company operating entirely in the private sector. The latter come in many forms and sizes, with larger companies offering the best opportunities and career potential, especially for entry-level archaeologists. Most public archaeology activity operates through government, although a few private-sector firms also specialize in this work.

If you choose to work in the public sector, you can find opportunities in many federal government agencies, among them the National Park Service and the Bureau of Land Management. Many archaeologists work for state archaeological surveys and other such organizations. Historical societies, such as that in Ohio, often employ archaeologists.

You can obtain information about careers in archaeology from our professional associations, international, local, and national, to which most of us belong. In the United States, these include the Archaeological Institute of America, the Society for American Archaeology, and, for qualified professionals, the Register of Professional Archaeologists.

Academic Qualifications: Graduate School

An undergraduate degree in archaeology qualifies you to work as a gofer on a CRM excavation or an academic dig and little else, except for giving you a better knowledge than most people have of the human past—not something to denigrate as a source of enlightenment and enjoyment in later life. Many people work on CRM projects for a number of years and live in motels; they even have their own informal newsletter.

Any form of permanent position in archaeology requires a minimum of an MA (Master of Arts), which will qualify you for many government and private-sector positions. All academic positions at research universities and, increasingly, teaching posts require a PhD (Doctor of Philosophy).

Typically, an MA in archaeology requires two years of coursework and some form of data-based paper and, at some institutions, an oral examination. The MA may have a specialized slant, such as CRM or historic preservation, but most are general degrees that prepare you to teach at some two- or four-year colleges and universities and open you to many CRM or government opportunities. The advantage of the MA degree is that it gives you a broad background in archaeology, which is essential for any professional. It is the qualification of choice for many government and CRM or public archaeology positions.

The PhD is a specialized research degree, which qualifies you as a faculty member to teach at a research university and at many institutions that stress teaching and not research. This is the professional “ticket” for academic archaeologists and is certainly desirable for someone entering government or the private sector, where complex research projects and management decisions are often needed. The typical PhD program requires at least two years of seminar, course, and field training, followed by comprehensive examinations (written and often oral), MA papers, then a formal research proposal and a period of intensive fieldwork that, in written form, constitutes the PhD thesis.

In the United States, the average doctoral program takes about seven years to complete and turns you into a highly specialized professional, with some teaching and research experience. After these seven years,

you then have to find a job in a highly competitive marketplace. Yes, it is a daunting prospect to face seven years or more of genteel poverty, but the intellectual and personal rewards are considerable for someone with a true passion for archaeology and academic research. However, be aware that the PhD is a *research* degree, not a qualification for carrying out CRM and other professional activities that often require other skills.

Do not consider applying for a graduate program in archaeology unless you have the following:

- An academic record well above average, with in-depth coverage of archaeology and anthropology. An A-minus grade point average is a minimal requirement for good graduate schools; you also need good Graduate Record Examination (GRE) scores.
- A strong background in anthropology and a multidisciplinary perspective.
- Some field experience on a dig or survey.
- An ability to write good, clear English and to speak fluently in public (both skills acquired by experience).
- Strong and meaningful support from at least two qualified archaeologists who are able to write letters for you, who know you really well. The old adage about getting to know your professors is so true. A letter written by someone who knows you both as a person and as a student stands out from the crowd.
- A specific research interest, which is spelled out carefully in the statement of intent required on most graduate applications. It is very important that your emerging specialist interests coincide with those of the department of your choice and with the faculty members who work there. For example, it's no use applying to the University of California at Santa Barbara for PhD study in arctic North America. They have no one who teaches it. An obvious point, one would think, but one often ignored.
- A strong passion for archaeology and for teaching as well as research, a realistic expectation as far as the tight job market is concerned, and a moral commitment not to collect artifacts for profit or for personal gain.

A final word to the wise: If you feel your passion and interest in

archaeology waning as you progress through your graduate years, do not hesitate to quit. The experience may be traumatic in the short term, but there are many people in archaeology who quietly wish they had never chosen a career with seemingly limited prospects. They may not readily admit it, but they are out there. Do not become one of them!

Thoughts on Not Becoming a Professional Archaeologist

Over many years of teaching archaeology, Brian Fagan introduced thousands of people to the subject. Only a handful have become professional archaeologists. Most students who passed through his courses went on to an enormous variety of careers—Army Rangers, bureaucrats, international businesspeople, lawyers, politicians, real estate tycoons, teachers, and even chefs and pastry cooks. At least two of his former students are in jail! But every one of them is aware of archaeology and its role in the contemporary world, of the remarkable achievements of our ancient forebears. This is by far the most important teaching that he did, of far greater significance than any amount of professional training we may give graduate students.

Our task as teachers of introductory courses is not to recruit people to the field but to help create what the National Science Foundation calls “an informed citizenry.” Many students in these courses end up with no interest in archaeology whatsoever; they find it boring and irrelevant to their lives. But you can be sure that they have heard of the subject and its remarkable achievements and have decided where it fits in their lives. This is, after all, one of the objectives of an undergraduate education.

On the other hand, many people take a single course in archaeology and develop an active interest in the subject that endures through the rest of their lives. If you are one of those individuals, you can stay involved, at least tangentially, with archaeology in many ways.

Archaeology depends on informed amateur archaeologists (often called “avocationals”), who volunteer on excavations, in laboratories, and in museums. Many highly important contributions to archaeology come from amateur archaeologists, often members of local archaeological societies, who participate in digs and keep an eye out for new discoveries in their areas. There is a strong tradition of amateur

scholarship in archaeology, especially in Europe, where some avocationals have become world authorities on specialized subjects such as ancient rabbit keeping or specific pottery forms, and they publish regularly in academic journals.

Archaeology could not function without volunteers, whether on Earthwatch-supported excavations or through quiet work behind the scenes cataloging artifacts or running lecture programs. If you have a serious interest in volunteering and pursuing archaeology on a regular basis as an amateur, there are many ways to become involved through local organizations such as colleges, museums, archaeological societies, and chapters of the Archaeological Institute of America. In these days of highly specialized research and professional scholarship, it is easy to say there is no place for amateurs. This arrogant statement is nonsense and misses the point. Amateurs bring an extraordinary range of skills to archaeology. During our careers, we've worked with, among others, an accountant (who straightened out our excavation books), an architect, a professional photographer and artist (who was a godsend in the field), a jeweler (who analyzed gold beads), and an expert on slash-and-burn agriculture (who had a passion for environmental history). Your talents are invaluable, so don't take no for an answer!

Many people develop an interest in the past, which comes to the fore when they travel. Their background in archaeology obtained as an undergraduate enables them to visit famous sites all over the world as an informed observer and to enjoy the achievements of ancient peoples to the fullest. Our files are full of postcards and letters from obscure places, such as one mailed from Stonehenge: "Thank you for introducing me to archaeology," it reads. "I enjoyed Stonehenge so much more after taking your course." A postcard like this makes one's day, for archaeology cannot survive without the involvement and enthusiasm not only of professionals but also of everyone interested in the past. We are all stewards of a priceless, and finite, resource that is vanishing before our eyes.

Our Responsibilities to the Past

All of us, whether professional archaeologist, avocational fieldworker, casually interested traveler, or basically uninterested citizen, share a

common responsibility for the past. Practicing archaeologists are governed by carefully formulated ethical codes developed with the collaboration of professional societies (Vitelli and Colwell-Chanthaphonh, 2006). But there are fundamental ethics that should govern us all. It is our collective cultural heritage, whether the Parthenon, the pyramids of Giza, Cahokia, or the tomb of Chinese emperor Qin Shihuangdi. This past extends back deep into the Ice Age and beyond, for more than 2.5 million years—a precious legacy of cultural achievement that is unique to humanity and something that we must cherish and pass on to generations still unborn. We are as much stewards of the past as we are of the oceans, forests, and every part of the natural environment. Archaeology is different in one important respect: Once destroyed, its archives can never be reconstructed. They are gone forever. Professional archaeologists subscribe to strict and explicit ethics in their dealings with the past, but, in the final analysis, preserving the past for the future is the responsibility of us all. Simply put, they are:

- Treat all archaeological sites and artifacts as finite resources.
- Never collect artifacts for yourself or buy and sell them for personal gain.
- Adhere to all federal, state, local, and tribal laws relating to archaeological sites.
- Report every accidental archaeological discovery.
- Avoid disturbing any archaeological site, and respect the sanctity of all burial sites.

As we've emphasized many times in these pages, the world's archaeological sites are under attack from many sources: industrial development, mining, and agriculture, as well as treasure hunters, collectors, and professional tomb robbers. As long as there is a demand for antiquities among collectors and as long as we maintain our materialistic values about personal possessions, destruction of archaeological sites will continue unabated. Even the necessary legal controls to prevent destruction of archaeological sites are just barely in force in most parts of the world. Yet there is still hope, which stems from the enormous numbers of informed people who have gained an

interest in archaeology from university and college courses, or from chance encounters with archaeologists, or from their travels. If sufficient numbers of laypeople can influence public behavior and attitudes toward archaeological sites and the morality of collecting, there is still hope that our descendants will have archaeological sites to study and enjoy.

We're glad we became archaeologists and that our passion for the past remains unabated after many years in the field, laboratory, and classroom. We've met many extraordinary people and have been challenged by complex research problems that have taken our careers in unexpected directions. But the moments we cherish most are those occasions when we've stood on an archaeological site or among some deserted earthworks or weathered buildings and the past has suddenly come to life. We've been lucky to have experienced this many times: high in the Greek amphitheater at Epidaurus, where Euripides's stanzas echoed with perfect acoustics; on cloud-mantled earthworks in Britain, where you could almost hear the cries of Roman legionaries advancing into battle; and on a coastal shell midden in southern California, where one could imagine planked canoes landing on a fine summer evening. These moments come without warning and are deeply emotional, triggered by evocative sunsets, effects of cloud and light, or even by a chance thought, but they are utterly precious. The past is personal to us, however dedicated a scientist we are, or however casually we visit a site. If the archaeological record vanishes, with all its great achievements and moments of brilliant success and long-forgotten tragedy, our successors will never be able to learn from the experience of our forebears or enjoy the powerful and extraordinarily satisfying emotional pull of the past. We owe this legacy to our grandchildren.

Summary

1. This chapter summarized the essential qualities of someone seeking to become an archaeologist and identified some of the career opportunities.
2. Career opportunities for professional archaeologists can be found in universities, colleges, museums, government service, and

- private businesses, both in the United States and abroad.
3. Most archaeological jobs require at least an MA and very often a PhD. Do not consider becoming a professional archaeologist unless you have an above-average academic record, some field experience, strong support from your professors, and a moral commitment not to collect artifacts for profit.
 4. Even people who have no intention of becoming professional archaeologists can gain digging experience by attending a field school or by digging overseas. Archaeology can give you insight into the past and the potential for involvement as an informed layperson. It will also enable you to enjoy the major archaeological sites of the world in a unique way and to aid in archaeologists' attempts to preserve the past.
 5. All of us have ethical responsibilities to the past: not to collect artifacts, to report new finds, and to obey federal, state, and tribal laws that protect archaeological sites. Unless we all take our responsibility to the past seriously, the past has no future.

Further Reading

- Ellick, Carol J., and Joe E. Watkins. 2011. *The Anthropology Graduate's Guide*. Walnut Creek, CA: Left Coast Press.
- Flatman, Joe. 2011. *Becoming an Archaeologist: A Guide to Professional Pathways*. Cambridge: Cambridge University Press.
- Vitelli, Karen D., and Chip Colwell-Chanthaphonh, eds. 2006. *Archaeological Ethics*. Lanham, MD: AltaMira Press.

Useful Addresses

Information on archaeological field schools can be obtained from fliers posted on university department bulletin boards and also from the Society for American Archaeology. Here are four addresses from which you can obtain information about archaeological activities and excavations that need volunteers:

Archaeological Institute of America
Box 1901, Kenmore Station

Boston, MA 02215

The Archaeological Institute of America publishes the *Archaeological Fieldwork Opportunities Bulletin*. Members receive *Archaeology Magazine*. The *Fieldwork Bulletin* can be accessed on the Web at www.archaeological.org.

Society for American Archaeology
900 Second Street NE, #12
Washington, D.C. 20002-3557

The Society for American Archaeology is the professional organization for all American archaeologists and many professionals in other fields. Society members receive a newsletter, *The Archaeological Record*, and *American Antiquity* or *Latin American Antiquity*, both more technical journals than *Archaeology Magazine*. You can contact the society at www.saa.org.

The Council for British Archaeology
Bowes Morrell House
111 Walmgate
York YO1 2UA, England

Contact the Council for British Archaeology for excavation opportunities overseas. This admirable organization maintains complete details of volunteer excavations in Britain and sometimes in other parts of the world. Go to <http://www.britarch.ac.uk>.

American Anthropological Association
2200 Wilson Blvd., Suite 600
Arlington, VA 22201

The American Anthropological Association maintains some information on field schools and fieldwork opportunities. Go to www.aaanet.org.

Practically every archaeological organization, and most significant sites and research projects, can be located on the Web, simply by accessing them through Google, Yahoo!, and other search engines.

Glossary

This glossary is designed to give informal definitions of words and ideas in the text, particularly those that are theoretical; it is not a comprehensive dictionary of archaeology. Jargon is kept to a minimum, but a few technical expressions are inevitable. Terms such as adaptation and mutation, which are common in contexts other than archaeology, are not listed; a good dictionary will clarify them. The key terms are in boldface type in the text. However, some commonly used words in the archaeological vocabulary (e.g., unaerated) are also included in case you need them; they are not boldface in the text.

absolute (chronometric) chronology Dating in calendar years before the present; chronometric dating.

accelerator mass spectrometry (AMS) radiocarbon dating A radiocarbon dating method that uses a mass spectrometer; more accurate than conventional radiocarbon dating.

activity area A pattern of artifacts in a site indicating that a specific activity, such as stone-tool making, took place.

activity set A set of artifacts that reveals the activities of an individual.

alluvium Geological deposit laid down by the action of a river or a stream.

analogy A process of reasoning whereby two entities that share some similarities are assumed to share many others.

analysis A stage of archaeological research that involves describing and

classifying artifactual and nonartifactual data.

annealing The process of heating and cooling metal to make it less brittle.

anthropology The study of humanity in the widest possible sense. Anthropology studies humanity from the earliest times to the present; it includes cultural and physical anthropology and archaeology.

antiquarian Someone interested in the past who collects and digs up antiquities unscientifically, in contrast to the scientific archaeologist.

archaeological context See *context*.

archaeological culture A group of assemblages at several sites representing the surviving remains of an extinct culture.

archaeological record Artifacts, sites, and other human-manufactured features or results of ancient human behavior and their matrices.

archaeological region A well-defined geographic area bounded by a conspicuous geographic feature, such as an ocean, a lake, or mountains.

archaeological survey Systematic attempts to locate, identify, and record the distribution of archaeological sites on the ground and against the natural geographic and environmental background.

archaeological theory A body of theoretical concepts providing both a framework and a means for archaeologists to look beyond the facts and material objects for explanations of events that took place in prehistory.

archaeological unit An arbitrary unit of classification set up by archaeologists to separate conveniently one grouping of artifacts in time and space from another.

archaeologist Someone who studies the past using scientific methods, with the motive of recording and interpreting ancient cultures rather than collecting artifacts for profit or display.

archaeology A special form of anthropology that studies (usually

extinct) human societies using the material remains of their behavior. The main objectives of archaeology are to understand and reconstruct culture history, study cultural process, and conserve and manage archaeological sites.

archaeology of gender The study of gender relations in the past.

archaeology of inequality The study of social inequality in the past.

archaeology of mind The study of religious beliefs and other ancient intangibles.

archaeomagnetic dating Chronometric dating using magnetic alignments from buried features, such as pottery kilns, which can be compared with known fluctuations in the earth's magnetic field to produce a date in years.

Archaic In the New World, a period when hunter-gatherers were exploiting a broad spectrum of resources and may have been experimenting with agriculture.

area excavation See *horizontal (area) excavation*.

artifact Any object manufactured or modified by human beings.

assemblage All the artifacts found at a site, including the sum of all subassemblages at the same location.

association The relationship between an artifact and other archaeological finds and a site level, or another artifact, structure, or feature in the site.

Assyriologist A student of the Assyrian civilization of Iraq.

astroarchaeology The study of ancient astronomical knowledge.

attribute A well-defined feature of an artifact that cannot be further subdivided. Archaeologists identify types of attributes, including form, style, and technology, in order to classify and interpret artifacts.

attribute analysis Analyzing artifacts using many of their features. Normally these attributes are studied statistically to produce clusters of attributes that can be used to identify statistical classes of artifacts.

attritional age profile The distribution of ages at death of animals in a population that were killed by selective hunting or predation.

auger A drill, either hand- or power-driven, used to probe subsurface deposits.

Australopithecus Primate whose fossil remains have been found mainly in eastern and southern Africa. Thought to be closely related to early *Homo* hominins who may indeed have evolved from australopithecines.

band The simple form of human social organization that flourished for most of prehistory. A band consists of a family or a series of families, normally with twenty to fifty people.

biblical archaeology The study of the archaeology of the Scriptures.

biosphere The earth's all living organisms interacting with the physical environment.

blade technology An advanced stone technology that produces parallel-sided stone flakes, normally removed from a carefully prepared core, often by means of a punch.

bowsing Technique for detecting buried features by thumping the ground and sensing the differences between compacted and undisturbed earth.

bulb of percussion The cone-like effect caused by conchoidal fracture on siliceous rocks.

bulbar surface The surface upon which the bulb of percussion occurs.

burin A blade tool, flaked on one or both ends to form a small chisel or grooving tool.

cambium A viscid substance under the bark of trees in which the annual growth of wood and bark takes place.

carrying capacity The number and density of people per square mile that a specified area of land can support, given a particular subsistence level.

catastrophic age profile Distribution of ages at death of animals in a population that died as a result of natural causes.

central-place theory A geographic theory applied to archaeology, stating that human settlements will space themselves evenly across a landscape as a function of the availability of natural resources and other factors. Eventually, these will evolve into a hierarchy of settlements of different size that depend on one another.

ceramic analysis The analysis of clay objects, especially pottery.

ceramic ecology The interaction of resources, local knowledge, and style that ultimately leads to a finished clay vessel.

ceramics Objects of fired clay.

characterization study The study of sources of raw materials used to make artifacts.

Chavín A distinctive art style that spread widely over the Andean region after 900 B.C. . Sometimes referred to as the Chavín Horizon.

chiefdom A form of social organization, more complex than a tribal society, that has evolved some form of leadership structure and mechanisms for distributing goods and services throughout the society. The chief who heads such a society and the specialists who work for the chief are supported by the voluntary contributions of the people.

chronological types Types defined by form that are time markers.

chronometric dating Dating in years before the present; absolute dating.

civilization See *state-organized society*.

clan A group of people from many lineages who live in one place and have a common line of descent; a kin grouping.

class A general group of artifacts, such as “hand axes,” that can be broken down into specific types, such as “ovates,” and so on.

Classic In Mesoamerica, the period of vigorous civilization characterized by numerous ceremonial centers and small states.

classical archaeology The study of the classical civilizations of Greece and Rome.

classification The ordering of archaeological data into groups and classes, using various ordering systems.

cognitive archaeology The study of human intangibles using archaeological data.

cognitive-processual approach An approach to archaeology that combines the processual approach with analogy and other methods to reconstruct ancient ideologies and intangibles.

collections management The long-term administration of archaeological finds in perpetuity.

community In archaeology, the tangible remains of the activities of the maximum number of people who together occupied a settlement at any one period.

complex In archaeology, a chronological subdivision of different artifact types, such as stone tools or pottery.

compliance process In cultural resource management (CRM), the process of complying with legislative requirements. Sometimes called the Section 106 process after that section of the National Historic Preservation Act of 1966.

component An association of all the artifacts from one occupation

level at a site.

conchoidal fracture A characteristic fracture pattern that occurs in siliceous rocks, such as obsidian and flint.

condition An event that forces people to make decisions about how to deal with a new situation.

confirmatory (inferential) statistics Statistical procedures used to make informed inferences about the characteristics of a population or the relationship between variables on the basis of data collected from a sample of the population.

conservation archaeology Another name for cultural resource management.

context The position of an archaeological find in time and space, established by measuring and assessing its associations, matrix, and provenance. The assessment includes study of what has happened to the find since it was buried in the ground.

coprolite Excrement preserved by desiccation or fossilization.

core In archaeology, a lump of stone from which human-struck flakes have been removed.

core borer A hollow tube-like instrument used to collect samples of soils, pollens, and other materials from below the surface.

cosmology (cosmos) A society's view of the universe.

cranial Of or pertaining to the skull (cranium).

critical archaeology The study of the meanings behind ancient material culture.

crop mark Differential growth in crops and vegetational cover that reveals the outlines of archaeological sites from the air.

cross-dating Dating of sites by means of objects or associated artifacts

of known age.

cultural anthropology The aspects of anthropology focusing on human social life, past and present, and on how cultures adapt to the environment.

cultural ecology The study of the dynamic interactions between human societies and their environments. With this approach, culture is the primary adaptive mechanism used by human societies.

cultural evolution A theory similar to that of biological evolution that argues that human cultures change gradually over time as a result of a number of cultural processes.

cultural materialism An approach to archaeology that stresses the complex relationships between technology, economy, and environment.

cultural process A deductive approach to archaeological research that is designed to study the changes and interactions in cultural systems and the processes by which human cultures change throughout time. Processual archaeologists use both descriptive and explanatory models.

cultural resource management (CRM) The conservation and management of archaeological sites and artifacts as a means of protecting the past.

cultural resources Human-made and natural physical features associated with human activity.

cultural selection The process that leads to the acceptance of some cultural traits and innovations that make a culture more adaptive to its environment; somewhat akin to natural selection in biological evolution.

cultural system A perspective on culture that views culture and its environment as a number of linked systems in which change occurs through a series of minor, linked variations in one or more of these systems.

cultural tradition In archaeology, a distinctive tool kit or technology that lasts a long time, longer than the duration of one culture, at one locality or several localities.

cultural transformations Changes in the archaeological record resulting from later human behavior, such as digging beneath a rubbish pit into earlier levels.

culture A set of designs for living that help mold human responses to different situations. Culture is our primary means of adapting to our environment. In archaeology, a culture is an arbitrary unit applied to similar assemblages of artifacts found at several sites, defined in a precise context of time and space.

culture area An arbitrary geographic or research area in which general cultural homogeneity is found.

culture history An approach to archaeology that assumes that artifacts can be used to build up a generalized picture of human culture and descriptive models in time and space and that these can be interpreted.

cumulative recording Excavating and recording a trench in three dimensions, using both horizontal and vertical observations to reconstruct events at the site.

cuneiform The earliest known script from Mesopotamia, consisting of wedge-shaped markings (from the Latin *cuneus*, “wedge”).

curation Deliberate attempts by prehistoric peoples to preserve key artifacts and structures for posterity. Also used in a modern context to describe the careful management of artifacts and other data recovered in archaeological research.

cylinder-hammer (method) Stone-flaking technique using a bone hammer that removes small, flat flakes from a core.

data The natural materials recognized by the archaeologist as significant evidence, all of which are collected and recorded as part of the research.

datum point A location from which all measurements on a site are made. The datum point is tied into local survey maps.

debitage Waste by-products resulting from the manufacture of stone tools.

deduction A process of reasoning that involves testing generalizations by generating hypotheses and trying them out with data. Deductive research is cumulative and involves constant refining of hypotheses. Contrasts with inductive approaches, which proceed from specific observations to general conclusions.

deductive-nomological approach A way of explaining observable phenomena by means of formal scientific methods, testing hypotheses generated from general laws governing human behavior. Some archaeologists believe that this is the appropriate way to explain cultural processes.

deductive reasoning The formulation of specific implications from a generalized hypothesis.

demography The study of population.

dendrochronology Tree-ring chronology.

deposited assemblage The carcasses or portions of carcasses that come to rest in a site.

descriptive statistics Techniques that provide a means for organizing and quantifying archaeological data in a manner that facilitates objective comparison while preserving the inherent structure of the data.

descriptive types Types based on the physical or external properties of an artifact.

diet What is eaten by humans (or animals).

diffusion The spread of a culture trait from one area to another by

means of contact among people.

direct historical approach The archaeological technique of working backward in time from historic sites of known age into earlier times.

distal Describing the end of a bone farthest from the skeleton's center line; opposite of proximal.

distribution of communities The density and spatial patterning of communities across the landscape, as determined by economic, environmental, social and religious, subsistence, and technological constraints.

ecofact Archaeological finds that are of cultural significance but were not manufactured by humans, such as bones and vegetal remains. Not a commonly used term.

ecological approach An approach to archaeology that studies the relationship between ancient societies and their changing environments.

economic catchment area The area from which the food resources consumed by the inhabitants of a site are obtained.

ecosystem An environmental system maintained by the regulation of trophic levels (vertical food chains) and by patterns of energy flow.

ecotone A transition zone between habitats.

Egyptologist A student of the cultures of ancient Egypt.

electronic spin resonance (ESR) dating A dating technique that measures radiation-induced defects or the density of trapped electrons within a bone or shell sample without the need to heat them.

engendered archaeology An approach to archaeology that uses a wide diversity of archaeological methods and approaches to find out how gender functioned in ancient societies, to unravel its cultural meanings.

environmental determinism In archaeology, a school of thought that

considers climatic and environmental change as the primary causes of culture change.

environmental impact statement A document that spells out the impact of modern development on the archaeological record in a specific area.

epigrapher One who studies inscriptions.

epiphysis The articular end of a long bone, which fuses at adulthood.

ethnoarchaeology Living archaeology, a form of ethnography that deals mainly with material remains. Archaeologists carry out living archaeology to document the relationships between human behavior and the patterns of artifacts and food remains in the archaeological record.

ethnography A descriptive study, normally an in-depth examination of a culture.

ethnohistory Study of the past using non-Western, indigenous historical records and especially oral traditions.

ethnology A cross-cultural study of aspects of various cultures, usually based on theory.

eustatic Referring to a process of adjustments in sea levels and the earth's crust resulting from expansion and contraction of Pleistocene ice sheets.

evolutionary approach An explanatory framework for the past that accounts for structure and change in the archaeological record.

excavation The digging of archaeological sites, removing the matrix and observing the provenance and context of the finds therein, and recording them three dimensionally.

exchange system A system for exchanging goods and services between individuals and communities.

exogamy A rule requiring marriage outside a social or cultural unit (endogamy means the opposite).

experimental archaeology The use of carefully controlled modern experiments to provide data to aid in the interpretation of the archaeological record.

exploratory data analysis (EDA) Quantitative methods specifically designed to aid in detecting patterns and deviations in sets of data by relying heavily on visual displays of data rather than on summary statistics and statistical significance tests.

extrasomatic Outside the body.

faience Glazed terracotta.

feature An artifact such as a storage pit or a posthole that cannot be removed from a site; normally, it is only recorded, not removed.

feces Excrement.

feedback A concept in archaeological applications of systems theory reflecting the continually changing relationship between cultural variables and their environment.

fire setting Quarrying stone by using fire to shatter the outcrops of rock.

fission-track dating Observing accumulations of radioactivity in glass and volcanic rocks to produce absolute dates.

flake tools Stone tools made of flakes removed from cores.

flotation In archaeology, recovering plant remains by using water to separate seeds from their surrounding deposit.

focus Approximately equivalent to a phase.

form The physical characteristics—size and shape or composition—of any archaeological find. Form is an essential part of attribute analysis.

form analysis Analysis of artifacts based on the assumption that the shape of a pot or other tool directly reflects its function.

formal attributes Such features as the shape of the artifact, its measurable dimensions, and its components.

formation processes Human-caused or natural processes by which an archaeological site is modified during or after occupation and abandonment.

formative In Mesoamerica, the period when more complex societies and settlement patterns were coming into being; these led to the complex states of later times (contemporary with the rise of agriculture).

frequency seriation A seriation method that employs percentages of artifacts and their features to develop cultural sequences.

functional approach An approach to anthropology and archaeology that argues that human societies can be understood only by looking at the network of complex relationships that form their underlying structure.

functional types Types based on cultural use or function rather than on outward form or chronological position.

functionalism The notion that a social institution within a society has a function in fulfilling all the needs of a social organism.

general systems theory The notion that any organism or organization can be studied as a system broken down into many interacting subsystems or parts; sometimes called cybernetics.

geoarchaeology Archaeological research using the methods and concepts of the earth sciences.

geochronology Geological dating.

geographic information system (GIS) A system for mapping

archaeological and other data in digitized form, thereby allowing it to be manipulated for research purposes.

gift exchange An exchange system that operates on the basis of gift-giving relationships sustained between individuals or groups.

glaze A form of pottery slip with additives that cause the coating to vitrify in the kiln.

ground-penetrating radar (GPR) Radar used by archaeologists to locate subsurface features.

habitat An area in the biome where different communities and populations flourish, each with specific locales.

half-life The time required for one-half of a radioactive isotope to decay into a stable element. Used as a basis for radiocarbon and other dating methods.

heuristic Serving to find out; a means of discovery.

hieroglyphs Ancient writing featuring pictographic or ideographic symbols; used in Egypt, Mesoamerica, and elsewhere.

historical archaeology The study of archaeological sites in conjunction with historical records. Sometimes called historic sites archaeology.

historical particularism The use of anthropological data to plot culture areas.

historiography The process of studying history.

history The study of the past through written records.

Holocene Epoch The geological epoch since the Ice Age (from the Greek *holos*, “recent”).

hominin A member of the family Hominidae, represented today by one species, *Homo sapiens*.

horizon A widely distributed set of culture traits and artifact assemblages whose distribution and chronology allow researchers to assume that they spread rapidly. Often, horizons are formed of artifacts that were associated with widespread, distinctive religious beliefs.

horizontal (area) excavation Excavation of a large horizontal area, designed to uncover large areas of a site, especially houses and settlement layouts.

household unit An arbitrary archaeological unit defining artifact patterns reflecting the activities that take place around a house and assumed to belong to one household.

iconography The study of ancient beliefs through symbols.

ideology The knowledge or beliefs developed by human societies as part of their cultural adaptation.

ideology of domination A set of beliefs used to propagate any form of social inequality.

indigenous archaeology Archaeology carried out in collaboration with indigenous societies.

inductive reasoning Reasoning by which one proceeds from specific observations to general conclusions.

industrial archaeology The study of sites of the Industrial Revolution and later.

industry All the particular artifacts (bone, stone, wood) found at a site that were made at the same time by the same population.

inevitable variation The notion that cultures change in small cumulative increments over time. The reasons for these changes are little understood.

inferential statistics See *confirmatory (inferential) statistics*.

inorganic materials Objects that are not part of the animal or plant

kingdom, including objects of stone, clay, and metal.

intensive survey Archaeological survey that seeks to locate every site in an area.

interpretation The stage in research at which the results of archaeological analyses are synthesized and we attempt to explain their meaning.

invention Some kind of innovation, material or otherwise, produced by a person or group at one place at a single moment in time.

isostatic Referring to a process that causes the earth's crust to compensate for the additional weight of glacial ice during glacial episodes.

kiln An oven used for baking clay vessels and other ceramic objects at a high temperature.

kinship In anthropology, relationships between people that are based on real or imagined descent, or sometimes, on marriage. Kinship ties impose mutual obligations on all members of a kin group; these ties were at the core of most prehistoric societies.

knapper One who manufactures stone artifacts.

landscape A perception of an environment created by humans.

landscape signature The imprint of human activity on a natural landscape.

leaching Water seeping through the soil and removing the soluble materials from it.

Levallois technique Stoneworking technique that involves preparing a bun-shaped core from which one preshaped flake is removed.

life assemblage A community of live animals in their natural environment.

LiDAR Light detection and ranging technology that is the optical equivalent of radar and uses a laser range finder to measure elevation.

lineage A kinship that traces descent through either male or female members.

linguistics The study of language, which sometimes helps determine past events, such as the origins of Indo-Europeans.

lithic Of or pertaining to stone.

lithic analysis The study of stone tool technology, including replication of said technologies.

loess Windblown glacial soil.

lost-wax technique A method of bronze-working that employs a wax model of the object. The mold is assembled with wax in place of the artifact. The wax is then melted and replaced with molten bronze. The technique was much used by the Shang bronze workers of China.

macrobotanical remains Easily recognized plant remains such as maize cobs or pine nuts preserved in such contexts as hearths.

magnetometer survey A survey done with a subsurface detection device that measures minor variations in the earth's magnetic field and locates archaeological features before excavation.

market A place set aside specifically for trading.

material culture Technology and artifacts.

matriarchal Characterized by family authority resting with the woman's family.

matrilineal Characterized by descent reckoned through the female line only.

matrilocal Characterized by married couples living with or near the wife's mother.

matrix The surrounding deposit in which archaeological finds are situated.

Mesoamerica The area of Central America where state-organized societies (civilizations) developed.

Mesolithic A dated term sometimes applied by Old World archaeologists to the period of transition between the Paleolithic and Neolithic eras. No precise economic or technological definition has been formulated.

mica A mineral that occurs in a glittering, scaly form; widely prized for ornament.

midden A deposit of occupation debris, rubbish, or other by-products of human activity.

middle-range theory A way of seeking accurate means for identifying and measuring specified properties of past cultural systems.

Midwestern Taxonomic Method A hierarchical approach to classifying artifacts and human culture developed in the American Midwest during the 1930s.

migration The movement of an entire population from one area to another.

minimum number of individuals (MNI) A count of the number of individuals necessary to account for all the identifiable bones.

mitigation In archaeology, measures taken to minimize destruction on archaeological sites.

model A theoretical reconstruction of a set of phenomena, devised to explain them. Archaeological models can be descriptive or explanatory.

multilinear cultural evolution A theory of cultural evolution that sees each human culture as evolving in its own way through adaptation to its particular environment. Sometimes divided into four broad stages of

evolving social organization (band, tribe, chiefdom, and state-organized society).

natural transformations Changes in the archaeological record resulting from natural phenomena that occur after the artifacts are deposited in the ground.

natural type An archaeological type coinciding with an actual category recognized by the original toolmaker.

negative feedback A response to a system that lessens the chance of change.

Neolithic A dated Old World term referring to the period of the Stone Age when people were cultivating without metals.

niche The physical space occupied by an organism, its functional role in the community, and how it is constrained by other species and external forces.

nomology The study of general laws.

noncultural processes Site formation processes that result from natural processes rather than human actions.

nondestructive archaeology See *nonintrusive archaeology*.

nonintrusive archaeology Archaeological research that studies the past but does not involve disturbance of artifacts, sites, or their context.

normative view of culture A view of human culture arguing that one can identify the abstract rules regulating a particular culture; a commonly used basis for studying archaeological cultures over time.

number of identified specimens (NISP) A count of the number of bones or bone fragments from each species in a bone sample.

nutrition The ability of a diet to maintain a body in its environment.

object clustering An approach to typology based on clusters of human

artifacts that are seen as specific classificatory types.

obsidian Volcanic glass.

obsidian hydration dating A dating method that measures the thickness of the hydration layer in obsidian artifacts. The hydration layer is caused by absorption of water on exposed surfaces of the rock.

off-site areas Areas with low artifact densities that were important to ancient groups, such as field systems.

Oldowan A cultural complex that flourished in eastern Africa about 2.5–2 million years ago, characterized by simple stone technology. Associated with some of the earliest tool-making hominins.

opal phytoliths Minute particles of silica from plant cells created from hydrated silica dissolved in groundwater that is absorbed through a plant's roots and carried through its vascular system.

open system In archaeology, a cultural system that interchanges both energy and information with its environment.

operational taxonomic units (OTUs) Units based on similarities between all possible pairs of objects, using similarity coefficients.

oral tradition Historical traditions, often genealogies, passed down from generation to generation by word of mouth.

ordering In archaeology, the arranging of artifacts in logical classes and in chronological order.

organic materials Materials such as bone, wood, horn, or hide that were once living organisms.

ossification The fusion of a limb bone with its articular end. Implies calcification of soft tissue into bonelike material.

osteologist One who studies bones.

paleoanthropology The study of the earliest human beings.

paleoethnobotanist One who studies ancient botany.

paleoecology The modern study of past ecology.

Paleolithic The Old Stone Age.

paleontology The study of fossil (or ancient) animal bones.

palyndology The analysis of ancient vegetational change through the use of fossil pollen grains.

passage grave A communal megalithic tomb with a central passageway, often with burial chambers on either side.

patination Natural weathering on the surface of rocks and artifacts.

patrilineal Characterized by descent reckoned through the male line only.

patrilocal Characterized by married couples living with or near the husband's father.

pedology The scientific study of soil.

periglacial Surrounding a glacial area.

period An archaeological unit defining a major stretch of prehistoric time; it contains several phases and pertains to a wide area.

permafrost Permanently frozen subsoil.

petrological analysis Examination of thin sections of stone artifacts to determine the provenance of the rock used to make them.

petrology The study of rocks; in the field of archaeology, the analysis of trace elements and other characteristics of rocks that were used to make such artifacts as ax blades that were traded over long distances.

phase An archaeological unit defined by characteristic groupings of cultural traits that can be identified precisely in time and space. A

phase lasts for a relatively short time and is found at one or more sites in a locality or region. A phase's culture traits are clear enough to distinguish it from other phases.

physical anthropology Biological anthropology, which includes the study of fossil human beings, genetics, primates, and blood groups.

planimetric maps Maps used to record details of archaeological sites; they contain no topographic information.

Pleistocene Epoch The last major geological epoch before recent times (the Holocene Epoch), extending from about 2 million years ago until about 11,500 years ago. It is sometimes called the Great Ice Age.

pollen analysis See *palynology*.

population In sampling methods, the sum of sampling units selected within a data universe.

positive feedback A system's response to external stimuli that leads to further change and reinforces it.

Postclassic A stage in Mesoamerican prehistory during which militarism arose, such as that of the Aztec.

postprocessual archaeology Theoretical approaches that search for the meaning of the archaeological record, for the ideology and structure of ancient societies. A reaction to processual archaeology.

potassium-argon dating An absolute dating technique based on the decay rate of potassium-40, which becomes argon-40.

potsherd A fragment of a clay vessel.

Preclassic See *Formative*.

predictive survey A survey that uses sampling to build a database for predicting site distributions. Normally used over larger areas.

prehistorian An individual who studies prehistoric archaeology.

prehistoric archaeology The study of prehistoric times.

prehistory The millennia of human history preceding written records.

pressure flaking A stoneworking technique in which thin flakes are removed from a core or an artifact by applying hand or chest pressure.

pre-state society An egalitarian society without stratified social classes or centralized government.

primary context An undisturbed association, matrix, and provenance.

probability sampling Archaeological sampling based on formal statistical criteria. This method enables researchers to use probability statistics in analyzing data.

process In archaeology, the culture change that takes place as a result of interactions between a cultural system's elements and the system's environment.

processual archaeology An approach to archaeology that studies the processes of culture change, usually through a systems, environmental approach.

provenance The position of an archaeological find in time and space, recorded three-dimensionally.

proximal Describing the end of a bone nearest to the skeleton's center line; opposite of distal.

public archaeology A form of archaeology open and accessible to the public through a variety of media.

pulse radar Use of a pulse induction meter that applies pulses of magnetic field to the soil; this method can be used to find graves, metals, and pottery.

Quaternary period Geological period since the beginning of the Pleistocene Epoch up to recent times (the Holocene Epoch). The exact date of its commencement is uncertain, but it was more than 2 million

years ago.

radiocarbon dating An absolute dating method based on measuring the decay rate of the carbon isotope carbon-14 to stable nitrogen. The resulting dates are calibrated with tree-ring chronologies to convert radiocarbon ages into dates in calendar years.

random sampling Sampling based on a totally random selection of sample units to be investigated.

reciprocity In archaeology, the exchange of goods between two parties.

reconnaissance survey Archaeological survey carried out on a preliminary basis, often using sampling methods.

redistribution The dispersing of trade goods from a central place throughout a society, a complex process that was a critical part of the evolution of civilization.

reduction sequence The sequence of actions involved in the manufacture of an artifact by means of reductive technology.

reductive (subtractive) technology Stoneworking technique in which stone is acquired, then shaped by removing flakes until the desired form is achieved.

refitting The reassembling of stone debitage and cores to reconstruct ancient lithic technologies.

relative chronology A time scale developed by the law of superposition or artifact ordering.

remote sensing Reconnaissance and site survey methods using such devices as aerial photography to detect subsurface features and sites.

research design A carefully formulated and systematic plan for executing archaeological research.

resistivity survey The measurement of differences in electrical conductivity in soils, used to detect buried features, such as walls and

ditches.

sample assemblage The bone sample that is collected by zooarchaeologists and analyzed in the laboratory.

sample unit An arbitrary or nonarbitrary unit of the data universe, used for sampling archaeological data.

scanner imagery A method of recording sites from the air using infrared radiation that is beyond the practical spectral response of photographic film. Useful for tracing prehistoric agricultural systems that have disturbed the topsoil over wide areas.

science A way of acquiring knowledge and understanding about the parts of the natural world that can be observed and measured; a disciplined and highly ordered search for knowledge carried out systematically.

scientific method A method of inquiry that is based on the formal testing of hypotheses, cumulative research, and replicable experiments.

seasonality Seasonal occupation.

secondary context A context of an archaeological find that has been disturbed by subsequent human activity or natural phenomena.

selective excavation Archaeological excavation of parts of a site using sampling methods or carefully placed trenches that do not uncover the entire site.

seriation Methods used to place artifacts in chronological order; artifacts closely similar in form or style are placed close to one another.

settlement archaeology The study of changing ancient settlement patterns against their environment.

settlement pattern Distribution of human settlement on the landscape and within archaeological communities.

shadow site Archaeological site identified from the air, where oblique

light can show up reduced topography of sites invisible on the ground.

shaman An individual with unusual supernatural powers and the ability to communicate with the spiritual world.

shovel unit A small cutting made with a shovel to test the limits of a site and to collect artifact samples.

site Any place where objects, features, or ecofacts manufactured or modified by human beings are found. A site can range from a living site to a quarry site, and it can be defined in functional and other ways.

site assessment The assessment of the significance of a site by survey and other nonintrusive means.

site-catchment analysis Inventorying natural resources within a given distance of a site.

site-exploitation territory The potential area from which food resources may be obtained.

site formation processes Cultural and noncultural phenomena that act on the formation of the archaeological record.

site survey The collection of surface data and evaluation of each site's archaeological significance.

slip A fine, wet finish applied to the surface of a clay vessel before it is fired and decorated.

social anthropology The study of human society and social organization.

social ranking Social distinctions between individuals, communities, and other units of society.

sociocultural Combining social and cultural factors.

soil mark A distinctive mark that turns up in plowed fields when subsurface features show up on aerial photographs.

sondage See *test pit*.

sourcing See *characterization study*.

spatial context The relationships between the positions of different objects in archaeological deposits.

spectrographic analysis Chemical analysis that involves passing the light from a number of trace elements through a prism or diffraction grating that spreads out the wavelengths in a spectrum. It enables researchers to separate the emissions and identify different trace elements. A useful approach for studying metal objects and obsidian artifacts.

stable carbon isotope analysis A method of identifying types of plant foods from the isotopic analysis of ancient bone and hair. By using the ratio between two stable carbon isotopes—carbon-12 and carbon-13—in animal tissue, researchers can evaluate ancient diets.

stage A technological subdivision of prehistoric time that has little chronological meaning but denotes the level of technological achievement of societies within it, such as the Stone Age.

stakeholder A person or group in a specific area with a vested interest in the archaeological record, but not necessarily as only an archaeologist.

state-organized society A socially stratified society with strongly centralized government, social complexity, and, often, writing.

statistical typologies Artifact classifications developed by statistical grouping of artifact attributes.

stelae (or stele) A column or stone slab, often with an inscribed or sculptured surface; plural, stelae.

stewardship In archaeology, the conservation and management of the archaeological record for future generations.

stratified sampling A probabilistic sampling technique used to cluster and isolate sample units, when regular spacing is inappropriate for cultural reasons.

stratigraphy Observation of the superimposed layers in an archaeological site.

stratum A single deposited or cultural level.

structural approach (structural archaeology) A theoretical approach to archaeology based on the assumption that codes and rules produce observed systems of relations in human culture.

structure A feature intended for household or group activity, such as a house or a temple.

stylistic analysis Artifact analysis that emphasizes style and decoration.

stylistic attributes Attributes based on stylistic features, such as color and decoration.

stylistic types Types based on stylistic distinctions.

subarea The subdivision of an archaeological area, normally defined by geographical or cultural considerations.

subassemblage An association of artifacts denoting a particular form of activity practiced by a group of people.

superposition The relationship between two objects, structures, or layers in the vertical plane.

surface survey The collecting of archaeological finds from sites with the objective of gathering representative samples of artifacts from the surface. Surface surveys also establish the types of activity on the site, locate major structures, and gather information on the most densely occupied areas of the site that could be most productive for total or sample excavation.

synthesis The assembling and analyzing of data preparatory to interpretation.

systematic sampling A refinement of random sampling in which one unit is chosen, then others at regular intervals from the first; useful for studying artifact patterns.

systematics In archaeology, procedures for creating sets of archaeological units derived from a logical system for a particular purpose.

systems-ecological approach An approach to archaeology that is based on a systems approach to culture change and to the complex relationships between human cultural systems and their ecological systems.

taphonomy The study of the processes by which animal bones and other fossil remains are transformed after deposition.

taxonomy An ordered set of operations that results in the subdividing of objects into ordered classifications.

technological analysis The study of technological methods used to make an artifact.

technological attributes Attributes based on technological features of an object, such as the materials used.

tectonic Referring to the earth's crust; a tectonic movement is an earthquake.

tell An Arabic word for small hill or mound; used to refer to archaeological sites of this type in southwestern Asia.

temper Coarse material such as sand or shell added to fine pot clay to make it bond during firing.

tempering A process for hardening iron blades that involves heating and rapid cooling.

test pit An excavation unit used to sample or probe a site before large-scale excavation or to check surface surveys.

theory The overall framework for archaeological research.

thermoluminescence (TL) dating A chronometric dating method that measures the amount of light energy released by a baked clay object when heated rapidly. Gives an indication of the time elapsed since the object was last heated.

thermoremnant magnetism The alignment of magnetic particles fixed by heating.

Three-Age System A technological subdivision of the prehistoric past developed in 1806 for Old World prehistory.

topographic maps Maps that can be used to relate archaeological sites to basic features of the natural landscape.

total excavation Complete excavation of an archaeological site. Normally confined to small sites, such as burial mounds or campsites and avoided where possible.

trace elements Minute amounts of chemical elements found in rocks that emit characteristic wavelengths of light when heated to incandescence. Trace-element analysis is used to study the sources of obsidian and other materials traded over long distances.

tradition A persistent technological or cultural pattern identified by characteristic artifact forms. These persistent forms outlast a single phase and can occur over a wide area.

transformational processes Processes that change an abandoned prehistoric settlement into an archaeological site through the passage of time. These processes can be initiated by natural phenomena or by human activity.

tribe A group of bands unified by sodalities and governed by a council of representatives from the bands, kin groups, or sodalities within it.

trypanosomiasis Sleeping sickness.

tsetse A fly that carries trypanosomiasis. Belts of tsetse-fly country in Africa prevent inhabitants from raising cattle.

tuff Solidified volcanic ash.

type In archaeology, a grouping of artifacts created for comparison with other groups. This grouping may or may not coincide with the tool types as they would have been intended by the original manufacturers.

type fossil A tool characteristic of a particular “archaeological era,” a dated concept borrowed from geology.

typology The classification of types.

unacrated Not exposed to the open air.

underwater archaeology The study of archaeological sites and shipwrecks beneath the surface of the water.

uniformitarianism The doctrine that the earth was formed by the same natural geological processes that are operating today.

unilinear cultural evolution A late nineteenth-century evolutionary theory envisaging all human societies as evolving, or being capable of evolving, along one track of cultural evolution, from simple hunting and gathering to literate civilization.

unit In archaeology, an artificial grouping used for describing artifacts.

uranium series dating A dating method that measures the steady decay of uranium into various daughter elements inside any formation made up of calcium carbonates, such as limestone or cave stalactites.

use-wear analysis Microscopic analysis of artifacts to detect signs of wear through use on their working edges.

vertical excavation Excavation undertaken to establish a chronological sequence, normally covering a limited area.

viewshed analysis The study of lines of sight relative to elevation in settlement archaeology. Usually conducted with GIS databases.

votive Intended as an offering as a result of a vow.

zooarchaeology The study of animal remains in archaeology.

Bibliography

This bibliography is not intended as a comprehensive reference guide to method and theory in archaeology. Rather, it is a compilation of some sources used to compile this book and a cross section of important methodological and theoretical research. In order to keep the bibliography within manageable limits, we have tended to cite general works, on the assumption that readers will use the references in them to delve more deeply into the literature.

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